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DECORATIVE DETAILS FROM THE EXHIBITION PALACE, PARIS.

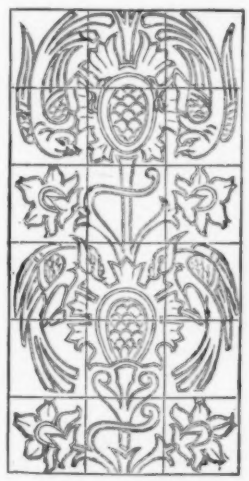
THE illustrations show one of the pillars as a whole; the crowning ornament in repoussé zinc being in larger scale. The ornamental motives belong to the terracotta frieze—glazed variegated ornament with dark outlines on gold colored ground—with which the intervals of the iron constructive features are clothed. Cartouche in repoussé zinc in summit of iron arch of inside, at the height of 18 m.—*The Workshop.*

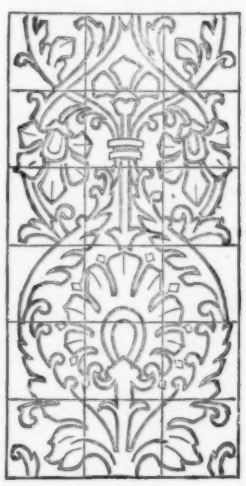
THE PARIS EXHIBITION AND ITS JURY.

THE doors of the Paris Exhibition are closed and the labors of the jury are terminated. The French industrial press abounds with criticisms and complaints against the jury, which, making all due allowances for unjustified outbursts of injured personal feelings, cannot lack foundation altogether, and some of the exhibitors are, as it seems, complaining justly.

We can, as a nation, certainly feel satisfied with the goodly share of the world's fair's honors brought home by American exhibitors, and quote only the views of a Paris journal, *Le Propagateur :*

"Mr. de Moutencamp, a member of an old aristocratic family, but at the same time a large land owner and extensively interested in textile manufactures, exhibited a machine by which, in connection with a peculiar preparatory process, the silk can be spun off the so-called 'double' and the 'wild' silkworm cocoons, furnishing a thread equal in brilliancy and tenacity to silk gained from ordinary cocoons. When it is taken into consideration that these cocoons were so far considered nearly worthless, that the





THE PARIS EXHIBITION—DECORATIVE DETAILS, EXHIBITION PALACE, TROCADERO. BY HARDY, ARCHT.

silk may therefore be produced considerably lower than formerly, and that the silk industry is one of the principal sources of wealth to France, one would certainly expect the jury to pay some attention to this subject, and, if deemed proper, to award suitable honors to the inventor.

"This, however, was not the case. Mr. Moutencamp, in order to demonstrate the tenacity and quality of a single thread of wild cocoons, only operated on one cocoon with his machine, not precluding, however, an operation on as many cocoons as desired. This the jury did not see, and the fate of the invention, for them at least, was settled. 'What is the machine good for, if the cocoons have to be operated upon one by one? Besides [when speaking of the samples of goods exhibited by Mr. de Moutencamp], how can we know whether these samples were really produced from 'wild' silk or not?' Mr. de Moutencamp offered to produce samples of equally good quality in presence of the jury, but that august body failed to see the propriety of devoting another half hour's time to the subject, and refused any other information. In consequence the invention did not receive any public recognition. Meanwhile Mr. Moutencamp has associated with himself Mr. Ziegler, a wealthy gentleman, known as an expert in textile manufactures, and proposes to introduce his invention practically on a large scale.

"This is the most flagrant case. Due more to ignorance and neglect in the rush of business seems to be the case of the well known house of Raspail. Four medals were officially awarded to that house. It is, however, honest enough to refuse one of them, and protest publicly against that award, on the ground that the house of Raspail had not exhibited at all in the class for which the medal was awarded.

"How an article can be honored by a medal without ever

THE SPANISH AGRICULTURAL PAVILION AT THE PARIS EXHIBITION.

being manufactured and exhibited, is a curious question.

"Mr. Faugon, the well known viniculturist of southern France, the inventor of the so far most successful method of destroying the phylloxera or grape louse, exhibited a treatise on this parasite, setting forth the best mode of destroying the insect and preserve the vineyards of France, that source of wealth. The jury passed over the valuable little work which has saved millions to the French wine growers, only according a minor award, on the ground that Faugon had not made any exhibit."

FINALE OF THE PARIS EXHIBITION.

THE Americans ran their machinery all the last week; and on Saturday afternoon, November 2, 1878, determined probably not to be outdone by the Britishers—at any rate as far as noise was concerned—they gave a small salute with the whistle, or rather hooter, taken from the Philadelphia and Reading locomotive, and rigged up for the occasion in the machinery hall. The vibration of air caused by this instrument, which we were assured is not nearly so large or so loud as some of the "blowers" in use, was so great as to be felt as well as heard at the end of the hall; and this noise was alternated by the working of Allen & Roeder's portable pneumatic riveting machine, and supplemented by cheering.

On the following day (Sunday, November 3, 1878), the gates were finally closed to the public without any ceremony; 122,012 persons were present, which brings the total number of admissions up to 16,032,725. The total receipts for the exhibition of 1878 are 12,653,746 fr.—nearly £506,150—against 9,830,369 fr.—£393,215—in 1867, showing an increase for the present year of 2,823,377 fr.—£112,935.

On Monday morning, November 4, 1878, the work of dismantling proceeded rapidly. The statues from the Val d'Osne foundry, which had adorned the grounds, were removed from their pedestals and carted away, while an army of navvies laid bare the several lines of rails, which had been covered with gravel walks, grass plats and flower beds, and re-established the points and turntables. The flooring in the machinery halls, both French and Foreign, was ripped up in order to expose the rails and allow a passage for the locomotive crane of Messrs. Appleby Brothers, which, admirably handled by "Jack" Turner, did such good service during the installation. This crane, with some other novelties brought out by the same firm, we have made arrangements to illustrate before long. Irrespective of the rails in the machinery department, a complete system of tramways, of 1 foot 8 inch gauge, was, between seven and twelve o'clock, laid down in the British sections. Starting from points in the Industrial Hall, the men worked in nine different directions, including the Fine Arts Department, and the Prince of Wales' Indian Collection, so that empty cases brought up in trucks, handled by Aveling & Porter's traction-engine, could be taken in rapidly to all parts, to facilitate the work of repacking and removing exhibits. This tramway was specially designed by Messrs. Appleby Brothers for the Royal Commission. It consists of light contractors' rails, in 15 foot lengths, connected by fish-plates, with four bolts, and having distance pieces every 5 feet. A 15 foot length of two rails can easily be carried to its place by two men, so that the work of laying down a temporary line is very simple. Practically, two bolts are found enough for each pair of fish-plates; and it is probable that in future keys will be substituted for nuts, one end of each fish-plate being turned up to serve as a bolt. The executive of the Royal Commission are taking up their steam-pipes with great rapidity, in order to get all well away by the end of the year, the limit of time allowed.

FOOD PRODUCTS—PARIS EXHIBITION.

ABSINTHE.

As might be supposed from the extensive cultivation of the vine in France, and the consequent abundance and cheapness of wine and alcohol, a great variety of *spirits* and *liqueurs* is manufactured. Nearly every fruit and vegetable substance having sensible properties of taste or smell is brought into requisition in their preparation, and even in some cases where neither the taste nor smell is particularly inviting. Thus, there is the "Absinthe" of evil reputation, which is so largely consumed in France, made from wormwood—*Artemisia absinthium;* and the "Vermouth," prepared from the same plant, and the reputation of which is consequently equally bad.

EUCALYPSINTHE.

Among the latest productions of this kind is "Eucalypsinthe," which, we are given to understand, is fast becoming much used, and is to be seen already in many of the cafes of Paris. It is a spirit made from the blue gum, *Eucalyptus globulus*, the smell and taste of which it possesses in a very marked degree. The sample of this liqueur which we examined was manufactured by Messrs. Bessède et Fils, of Marseilles. When a small quantity of it was mixed with water, the latter became white and opalescent, from the deposition of resinous matter contained in the preparation. It is claimed for it that "the eucalypsinthe is a drink not merely hygienic in the highest degree, but also aperient, febrifuge, alterative, refreshing, tonic, and digestive; economical and agreeable." What more could be desired! We only demur on the present occasion to the word "agreeable," and would merely observe that a person in health scarcely requires a drink possessing so many active, even if valuable qualities, the catalogue of which we have not, however, as yet exhausted. Eucalypsinthe "quenches thirst, rouses appetite, facilitates digestion, and awakens the intelligence and the memory by producing a general feeling of health." Eucalypsinthe in taste and color resembles absinthe—that is to say, it is equally abominable; but hear again the eloquent author in its praises, "The first glass surprises, the second pleases, the third conquers."

VARIOUS LIQUEURS.

Mors. Callard Jeune et Cie., Lyons, exhibit different liqueurs, amongst them a "Prunelle."

Messrs. E. Cusenier et Cie., Orleans, exhibit a considerable variety of liqueurs, some of much interest, and many of which, through their kindness, we have had the opportunity of examining. The principal are the following: "Curaço triple sec," "Curaço sec, Dubb orange, Amsterdam," "Curaço doux," "Crême de Menthe glaciale," "Crême de Cacao Chuova à la Vanille," "La Prunelle," "Liqueur Cusenier," "Soda Cusenier," "Kava de Vichy," and "Kummel." It will be observed that this list contains several novel liqueurs. Passing by the three curaços, which are really very good, we notice the Crême de Menthe, which possesses a strong odor of the peppermint, and is of a brilliant sap-green color; this, the inventor states, is derived entirely from the fresh leaf of the mint. This liqueur is pleasant to the taste, and forms an excellent stimulating tonic, suitable in cases of flatulency. La Prunelle, a favorite liqueur in France, is flavored with the kernel of the wild plum which grows so commonly in our hedges, and is better known by the name of the black or prickly thorn. The flavor is pleasant, resembling very much that of other liqueurs prepared from the kernels of fruits. Of Liqueur Cusenier it is only necessary to remark that it is one of very special composition and flavor, possessing considerable strength, and capable of acting as a powerful stimulant. The Soda Cusenier is one of a bright raspberry-red color. Used like a sirup, with the addition of some aerated water, it forms an exceedingly agreeable drink, and if the latter contain any soda the effervescence becomes extremely brisk owing to the fruit acid contained in the liqueur. We come now to notice a liqueur called Kava de Vichy; it is perfectly colorless, and the bottle containing it is thickly coated with a white crystalline crust, which gives it a very peculiar and attractive appearance. We find that this crust consists of sugar, which has assumed a beautiful crystalline form. This liqueur is very strong, and of a marked and special flavor. The last liquor to notice is Kummel. One of the principal flavoring matters contained in this is, as the name implies, "caraway." This liqueur was originally Russian, and made at Riga. Like the Kava, it is colorless, and the bottle is coated with a still more beautiful crystalline crust, which in like manner consists principally of sugar. This liqueur is also a powerful tonic and anti-flatulent. These several liqueurs are evidently prepared with very great care, and will doubtless still further improve by age. The taste displayed in the shape of the bottles, in the form and execution of the labels, and in the securing and sealing of the liqueurs, is particularly noticeable.

Mons. A. Demay, of Bordeaux, exhibits a bitter called "Bitter Demay."

The liqueurs next in order to be noticed are those of Mons. Desiré Taillandier, of Tours. This maker exhibits "Curaço Triple Sec," a liqueur called "La Tourangelle," and "Crême de Cacao." Each of these deserves a short special notice. The Curaço is a combination of alcohol with the bitter principle and volatile oil of the Seville orange. It is therefore a very natural mixture, and one possessing agreeable and useful stomachic properties. La Tourangelle is a liqueur between Chartreuse and Raspail. Lastly, the Crême de Cacao is compounded of alcohol, the volatile principle of cocoa, and a flavoring of vanilla. It also forms a very wholesome liqueur, and, in our judgment, the nicest and most delicate of all the liqueurs that are made. Of these three samples—all excellent—we greatly prefer the Crême de Cacao for its mildness and delicacy of taste and smell.

Messrs. Détang, whose distillery is situated near Beaune, are the makers of the liqueur called after the name of their estate, "La Petite Chartreuse," and also of "La Prunelle." Of the former, Messrs. Détang say that it has "fait le désespoir" of all other manufacturers of the same liqueur. We have examined it, and find that it is really very excellent and moderate in price. The Prunelle is also of very good quality.

Messrs. Fourgeaud-Lacoste, of Perigueux, exhibit, amongst other things, an "Elixir des Vosges," or Liqueur de Pin, which is, in fact, the specialty of the firm. "This Elixir derives its name from its principal base, which is the pine. It is exclusively composed of resins derived from the careful distillation of the pine buds of the Vosges, of the pollen of the maritime pine, and of certain other resinous substances, which, combined in proper proportions, make an excellent stomachic liqueur." It will be observed that this liqueur bears a general resemblance in its resinous character and composition to the analogous product derived from the Eucalyptus globulus, and which we have noticed under the name of Eucalypsinthe. It is specially recommended in catarrhal affections, principally those of the chest. Preparations made from the pine seem to be in high favor in France, and we believe there are some other makers of a similar liqueur.

Mons. V. Fauconnier, of Hesdin, is well known as the manufacturer of "Texa du Perou," or "Texine," and of "Vin de Quinquina." The Texa is a mixture of wine, herbs, and quinquina calisaya; texine has a somewhat similar composition, while that of the vin de quinquina is sufficiently expressed in its name. The Texa is a light, agreeable, aromatic tonic, well calculated to promote appetite, neither too bitter nor too alcoholic. The Texine is a stronger preparation, and differs from the former in flavor and smell, owing to its admixture with more herbs and flavoring substances. This, like the Texa, taken either before or after meals, would act as a tonic and digestive.

Mons. P. Garnier, of Enghien-les-Bains, exhibits liqueurs which he has named "Abricotine" and "Fleur de The."

Another exhibitor in this class is Mons. Ghesquier-Bouisset, of Lille, a very old established house. He exhibits a "Sweet and dry Curaço" and "Anisette," but his special products are three varieties of "Liqueur de Flandre," white, green, and yellow. The white is described as being less strong than either the green or yellow, and it is stated that it may be offered without danger to ladies or children. It has a very peculiar flavor and scent which many may like. It is certainly far too strong for children, and we fancy there are few women who would care to drink so highly alcoholized a liqueur. The yellow Liqueur de Flandre is described as a liqueur for the table and for dessert; it is spoken of by the inventor as the "digestive par excellence et le plus agréable," and that nothing will better crown a good repast than a glass of this liqueur. The green variety is the strongest of all, and possesses in a more marked degree the odor and taste which characterize the white liqueur, and its action is, no doubt, that of a powerful stimulant. The last preparation we shall notice exhibited by Mons. Ghesquier is a liqueur which he styles "Elixir Végétal." This is a very powerful combination, and, according to the inventor, exercises a sovereign action, and produces immediate relief in cases of indigestion, colic, faintness, syncope, etc.

Mons. L'Heritier-Guyot, of Dijon, exhibits samples of "Crême et Jus de Cassis." These preparations are made from a species of black currant, *Ribes nigrum*, the fruit of which attains great perfection as grown on the hills near Dijon, especially Fixin, Chambertin, and Vougeot. The Crême de Cassis has somewhat the color and taste of black currant, but with a milder, more aromatic, and less astringent flavor. This liqueur is said—and one can well believe it—to be serviceable and particularly strengthening in affections of the throat, doubtless partly owing to its astringency. It is taken sometimes alone, diluted with water, or, still better, in some aerated beverage; in this latter form it makes a very pleasant and refreshing drink, to be preferred in some cases, particularly in cold weather, owing to the alcohol it contains, to the fruit sirups which are so much used, especially in summer, in France. The sample of Crême de Cassis de Dijon we examined possessed a pleasant odor, with a rich and fruity taste, and may certainly be pronounced to be of excellent quality. The Crême de Cassis de Vougeot, made from the fruit grown on the hill of that name, is less sweet, and possesses more astringency; the *jus*, or juice, is free, or nearly so, from added sugar, and possesses in the most marked degree the aroma, taste, and astringency of the fruit from which it is prepared.

Messrs. Naltet, Menaud et Fils, of Chalons-sur-Saône, exhibit a liqueur called "Prunelle de Bourgoyne," and which is, doubtless, manufactured essentially in the same manner as other liqueurs bearing the same name.

Mons. Rouvière, of Dijon, is also an exhibitor of preparations made from Cassis, viz., "Crême de Cassis" and "Fleur de Cassis." The latter, through the kindness of Mons. Rouvière, we have also had the opportunity of tasting and examining, and we find it to possess in a high degree the odor and flavor of the fruit and to be of excellent quality. The combination of alcohol with the juice of Cassis is a very natural one, and it forms certainly one of the most wholesome of liqueurs.

Mons. Vialla, of Grenoble, manufactures and exhibits a "Bitter Hygiènique." This we have not had the opportunity of examining. It is curious to observe that in nearly every prospectus relating to the spirits and liqueurs, many of which we have noticed in this article, they are all described as eminently "hygiènique," the same term being applied to tea, coffee, wines, brandy, liqueurs, and even absinthe itself.

Mons. Vrignaud, of Luçon (Vendée), a very old established firm, dating three generations back, exhibits a variety of liqueurs, of which it will be necessary to notice in detail only the more remarkable. Amongst the exhibits are "Crême de Cacao à la Vanille," "Curaço triple sec jaune," "Anisette supérieure," "Cassis de Vendée," "Bitter Vrignaud," "Liqueur Hygiènique," "Elixir Vrignaud," (Chartreuse Jaune), and, lastly, three liqueurs prepared especially for the Exhibition, "Watermint," "Cafe Liqueur," and "Sirop Algérien." The Crême de Cacao possesses a very delicate aroma and flavor; the Cassis de Vendée has very much the full fruity odor and taste of the similar productions of the Cassis of the Côte d'Or. The Liqueur Hygiènique is identical with the well known Elixir of Raspail. The Watermint is a mild liqueur, smelling and tasting strongly of the mint; the Anisette is of a similar character, and both these liqueurs would be useful in cases of mild flatulent dyspepsia and colic. The Café Liqueur has the odor and taste of coffee in a very marked degree, and while Crême de Cacao consists of the aromatic principle of cocoa with a slight flavoring of vanilla, the Café Liqueur is in like manner composed of alcohol and the aromatic and flavoring constituents of coffee. The Elixir Vrignaud is, in fact, a yellow Chartreuse, prepared after the formula which is now no longer a secret, any more than is the receipt for making Eau de Cologne or Eau de Mélisse.

SIRUPS AND MINERAL WATERS.

There is a class of products which play a very important as well as a very agreeable part amongst French drinks. These are the various descriptions of "Sirops," or *Sirups*, which are made of different fruits. These sirups keep well, and possess the full flavor of the fruits from which they are prepared. Added in small quantity to water, or, better still, to some aerated or mineral water, they form a most refreshing drink, and one which we found, in our visits to the Exhibition, very agreeable. There was at the Exhibition a very complete and important collection of the *Mineral Waters of France*, and in the building in which these were shown was a large counter, behind which were several women engaged in supplying to a continuous stream of people glasses of the several mineral and table waters asked for. To each glass was added a small quantity of the drinker's favorite sirup, a very delicious beverage being thus supplied at the small charge of 15 centimes per glass—certainly the very cheapest article of refreshment in the Exhibition, where sometimes 2 f. 50 c. were charged for a slice of melon, and 4 f. for a small portion of beef steak. A favorite sirup is prepared from the gooseberry, and another from the lemon: "Sirop de Groseille" and "Sirop de Citron." It is a great pity that these sirups are not as generally used in England as they are in France, since they are not only very pleasant in themselves, but their consumption would greatly help the cause of temperance in this country.

Among the many exhibitors of sirups were Mons. Guibert of Bourges, and Messrs. Rosignol, Lefevre et Fils, of Lille. Among the curious preparations exhibited is one invented by Mons. Adolphe Obez of Douai, and which he calls "Sirop de Calabre." It is made from licorice root, gum, sugar, and treacle, the mixture being aromatized with some essences. This sirup, when diluted with water in the proportion of a liter of sirup to 300 of water is stated to form a pleasant and refreshing drink, much used for many years past in the army and principal manufactories of France. It is very inexpensive, and of course not at all intoxicating.

FRENCH BEERS.

We will now proceed to describe certain so called *beers* of novel composition, and with these our notices of alcoholized beverages will be brought to a conclusion. The first of these is the "Bière de Lait" of Messrs. Pawel, Landowski et Cie., of Paris. This product is described as being obtained by the alcoholic fermentation of milk with malt and hops, though it would be more correct to speak of whey, and not milk, since both the butter and the cheese of the milk are removed, so that all one really obtains in this beer, in addition to its ordinary constituents—seeing that the sugar of milk is, like that of the malt, converted into alcohol—are the phosphates, lactates, and other salts of milk. The proportion of milk, or rather whey, employed in making this beer is not stated, and it is important that this should be known. Messrs. Pawel, Landowski et Cie. were kind enough to place certain bottles of their "Bière de Lait" at our disposal. One of these we opened, and found the contents in excellent condition, soft, creamy, clear, bright, pleasant; and had we not been informed of the fact, we should not, judging from the taste alone, have suspected the presence of any of the component parts of milk.

The same firm exhibited a "Bière de Goudron"—that is to say, an ordinary beer, to which tar in certain proportions is added. The malt and hops, it is stated, mask the taste of the tar, which, thus administered, is said to exert its usual specific and beneficial action on the bronchial mucous membrane. We have not tasted this beverage, but the inventors state that, when once accustomed to it, it is often preferred to ordinary beer.

In the Pharmaceutical Department of the Exhibition we noticed several other preparations made with *goudron*, which seems to be a favorite remedy in French pharmacy.

Although we are unable to notice all the different beers

shown, there is one exhibited by the Société de la Bière Gallia, on which we will bestow a few words. This beer, in order to signalize its French origin, is called "Bière Gallia;" it is made, as are the beers of Germany, by bottom fermentation, with every advantage of modern machinery and appliance, and of the best possible materials. We have tasted and examined samples of this beer.

FRENCH FOODS.

We have now brought to a conclusion our remarks on the more interesting and important articles displayed by very many of the French exhibitors. These remarks have necessarily been very brief, but we trust that they have been sufficient to convey a tolerably accurate idea of the extent and variety of this portion of the Exhibition.

We failed to notice during our examination any specimens of what may be termed the Curiosities of French Food—such as fricasseed frogs, preserved frogs' legs, the two varieties of the edible snail, used especially for thickening soups, and said to be so beneficial in many cases of lung disease, different species of cuttle fish, sea hedgehogs, etc.

Many people have been accustomed to wonder and laugh at the French for liking and eating such things, but if we examine the matter by the light of common sense, the French certainly have the best of it, and deserve much praise for the discrimination and knowledge which they display in making use of sources of food supply rejected without reason by the people of other countries.

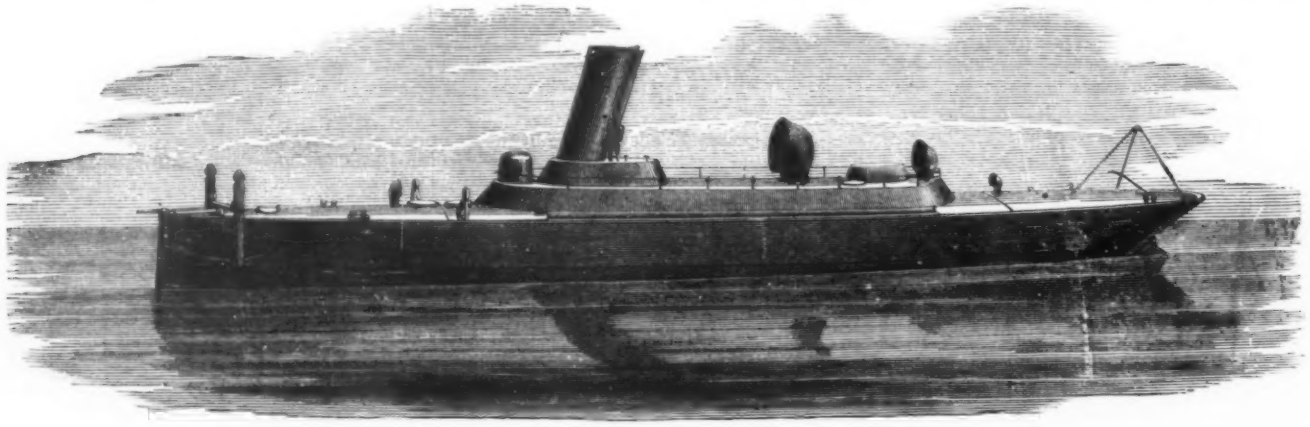
There is a great deal of mere fancy, and much more prejudice, about what many people eat, and what they refuse as food. Nearly every animal substance that is known is good for food; nearly every animal, every fish, and in fact every living thing to be found on the surface of the earth, or in the water, of any size, is good for food when prepared in a suitable manner. Now the French have realized this fact for many years past; it was they who first taught us the value of horse flesh, which in this country is given chiefly to our cats, and it was they who taught us to make use of nearly every fish caught in the sea. The quality of many of the articles thus consumed varies no doubt, but they are all sources of nourishment, containing those principles which are necessary for the sustenance of the body.

If one pays a visit to a French fish market, such as that of Boulogne, one is astonished at the large quantities of strange, uncouth looking, and often coarse, fish, which are there exhibited, but which yet find ready purchasers at, of course, moderate prices. If we visit the "Halles Centrales," in Paris, we there see bushels of snails, large, fat, and cleanly, quite as pleasing to the eye as are the whelks, winkles, and many other shell fish which are held in good esteem even by the fastidious British palate. In the same markets may be seen numerous bundles of frogs' legs, tied together in hundreds, and the flesh of which is more delicate than that of the tenderest fowl; indeed, the quantity often seen is amazing, and makes one think that the poor frog has a harder time of it in France than even in England, where nearly every part of his wonderfully constituted little frame is in constant requisition by the physiologist and the microscopist. Again, go to the shores of the Mediterranean, and inspect the fish market and the fishwomen's baskets in some of the towns of the Riviera—Cannes, for instance—and you will there see baskets full of different kinds of cuttle fish exposed for sale. These, too, find ready purchasers; indeed, by many they are esteemed as a great delicacy. You will also there see other baskets full of sea urchins, huge pinnas, many soft-bodied mollusks, and other curious creatures, which it would never enter into the imagination of an Englishman to regard as fit for food. Lastly, visit the market of the same town during the winter months, and you will there see dozens of strings of small birds, some of them numbering fifty or more, arranged on separate strings according to their species—thrushes, blackbirds, nightingales, starlings, larks, sparrows, linnets, and a great variety of other birds, including even the little robin redbreast, which with us is almost sacredly preserved. In fact, it would appear that no bird whatsoever is spared, no matter how beautiful its song or how rare its presence. We have even often seen the sparrow-hawk among the number, and on one occasion, what appeared to us very like some old lady's favorite parrot. All these birds find ready purchasers, and many of them are regularly served up at the hotels and restaurants, forming delicate and appetizing little morsels, which, no doubt, Englishmen partake of with relish, at the same time that they condemn, and rightly too, the practice of sacrificing to a greed for delicate food the smaller members of the feathered tribe, which are of so much real benefit to man while they live, by destroying myriads of insects, many of which are most destructive to growing crops. So much are these small birds in demand by French cooks, that in nearly every direction round a large town the capture and killing of them is made a regular pursuit. Men, so-called "chasseurs," armed with their guns, and furnished with a large bag, may daily be seen prowling down lanes, round gardens and private enclosures where birds congregate, much to the alarm and annoyance of foot passengers, and of the occupants of the houses.

Although, during our several inspections, we failed to see in so vast an Exhibition any examples of what we have termed the Curiosities of French Food, it by no means follows that some among the number, at least, were not exhibited. In conclusion, we would remark of the French collection that it is one of more interest, variety, and importance than we believe could be exhibited by any other country in the world, and this for reasons previously set forth.—*Lancet.*

RUSSIAN TORPEDO BOATS.

LAST spring ten torpedo boats were ordered by the Russian Government from Mr. S. Schichau, of Elbing, Eastern Prussia, and we have lately received some particulars of the performance of these boats, which have a special interest at the present time. The boats were all of one pattern, and we give on this page an engraving of one of them, which will show their external appearance, while we also give in another cut a perspective view of one of the engines. The boats are each 66 ft. long by 11 ft. 3 ins. beam, and they are built of steel plates 3 millimeters (0·12 in.) thick. The engines are three-cylinder compounds, with surface condensers, and have a high-pressure cylinder 9¾ in. in diameter, and two low-pressure cylinders, each 12⅝ in. in diameter, the stroke being 10¼ in. in each case. The high-pressure cylinder is placed between the two low-pressure cylinders, all three cylinders being made in one casting. The valve gear is of the Hackworth type, and the engine frames are entirely of wrought iron, as shown in our engraving. The engines run at 380 revolutions per minute, driving a screw 4 ft. in diameter. The boiler pressure is 10 atmospheres (147 lbs. per square inch), and the engines indicate 260 horse power. The boiler is of the locomotive type, and contains 830 square feet of heating surface, and is worked with a forced draught, the stokehole being closed, and air being forced into it by a fan 3 ft. 10 in. in diameter.



TORPEDO BOAT FOR THE RUSSIAN GOVERNMENT.

Early in July the boats, being completed, were sent in a fleet from Elbing to St. Petersburg, in charge of Mr. Ziese, the engineer of Mr. Schichau's works, and we have received from Mr. Ziese the following notes on this very interesting voyage, during which the sea-going properties of the boats underwent a severe trial:

"We started from Elbing," writes Mr. Ziese, "on the 7th of July, at 4.20 A. M., with three engineers and two sailors on board each boat, while each boat also took 60 cwt. of coal, 1 cwt. of oil and grease, provisions for four days, one mast and sail, oars, compass, and three life buoys.

"The weather was dull and rainy, the wind was blowing pretty hard, and on arriving at Pillau at 8.30 it was so stormy that we could not think of crossing the sea, and even the large steamers did not go out. At 11.45, however, we started after all, and took the direction towards Königsberg, the wind blowing a gale with a force of 8 to 9. The sea was rather rough and we got it all from astern; but we saw with some satisfaction that our boats were quite seaworthy, and that scarcely a drop came over. At 2 o'clock we arrived in Königsberg and proceeded to Labiau, where we arrived at 8.40 P. M., and stayed for the night.

"Next morning at 7 A. M. (July 8th) we started again, but were obliged to return on account of the strong westerly gales. At 9.45 the wind eased a little, and we went out. The sea was short and high and the boats went along in a regular cloud of spray and foam. The engines worked very satisfactorily. At 3 P. M. we arrived at Memel, and had to stay there several days on account of rough sea and weather. We tried to go out on the 11th, but were obliged to return.

"On the 12th of July, at 1 A. M., we started, passed Libau at 4.30, and arrived at Dominas the 13th of July at 2 A. M., the sea being quiet, and the wind westerly At Dominas met the customs steamer Strage, and took coals from her.

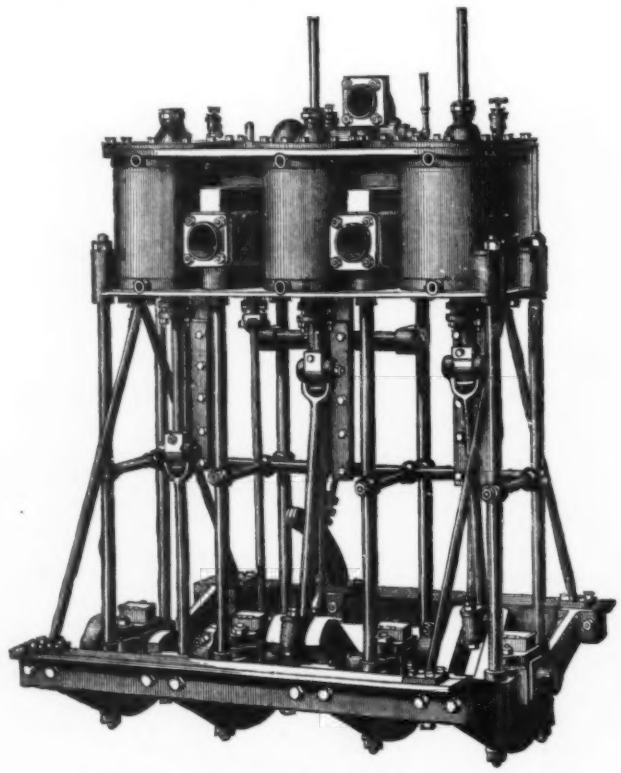
"The steamer went to Kniewasser, and we stayed till 6 15 A. M. to allow the men to rest awhile. Then we followed the Strage, and overtook her about 12 miles before coming to the Werder lighthouse.

"We then took coals again, and to allow the men a good rest, we had our torpedo boats towed through the Mousund. At 7 P. M. it began to blow rather fresh from the northwest, and we went to Clopsal, and stayed there for the night.

"At 12 o'clock the next morning (14th) we started for Reval, arrived there at 5 P. M., took more coals, and left at 10 P. M. for Hogland. The wind had gone down during the last few hours, but began to freshen up, and when we arrived at Hogland next morning at 5 A.M. it had reached a strength of 5 to 6. We anchored awhile, and tried to buy some coals, but not being able to get any we made the best of our small store and started for Bieke.

"When we had been one hour at sea, however, the gale blew so hard that we were obliged to seek shelter under Sommersöe. We had to run with the utmost of our engine power. The boats literally jumped from wave to wave, but did not ship much sea. They seemed to cling to the water with the screws. At 9 A. M. we made Sommersöe. A large paddle steamer coming in sight and hoping to obtain some coals we gave chase, overtook her, went alongside, and asked for some fuel, but had to return without, the people either not being able or willing to give anything. Next I asked the official of the lighthouse and obtained at last about 3 cubic yards of pine firewood.

"At 12.45 we left for Cronstadt. The firewood proved better than I expected, and we were able to maintain with



ENGINE OF RUSSIAN TORPEDO BOAT.

ease a pressure of 120 lbs., and we arrived at Cronstadt at 5.30 P. M. Having settled our custom-house affairs we left at 7.10, and went alongside the imperial yard at St. Petersburg at 8.20 P. M.

"We completed our whole voyage, about 630 knots, in 53 hours under steam, giving an average of nearly 12 knots per hour. The engines worked perfectly during the whole time, and scarcely a bearing had to be adjusted. The quantity of coals used in each boat was 140 cwt., giving an average of 2.8 cwt. per hour. With good Welsh coals we can do with 2 cwt. per hour. On the trial trips our torpedo boats ran from Petersburg to Cronstadt and back, 50 versts, or 29 knots, without stoppage, in 96 minutes."

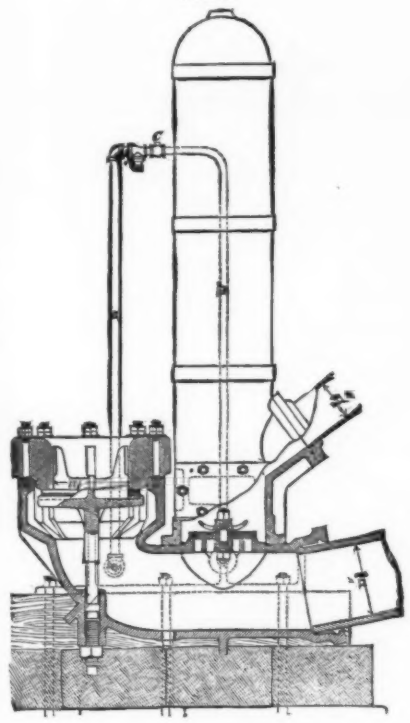
On the official trial of these torpedo launches, which took place in rather rough weather, each boat had to run for two hours with a supply of coal for five hours on board, and under these circumstances the average speed attained was over 17 knots per hour, and had the weather been fine it is considered that a speed of 18 knots would have been reached easily. The boats have by their performance earned from the Russian Government a premium of 20 per cent. above their contract price, and we understand that their good seagoing qualities are especially valued by their purchasers.—*Engineering.*

A MONTGOLFIER RAM.

By WASHINGTON JONES.*

RECENTLY the I. P. Morris Company made at their Port Richmond iron works, to be used for the purpose of irrigating the higher lands of a coffee plantation in South America, a hydraulic ram, whose capacity is greater than that of any other known to them. The following data were furnished by the purchaser with his order. As will be noticed, they cover the most important points, except the quantity

FIG. 1.

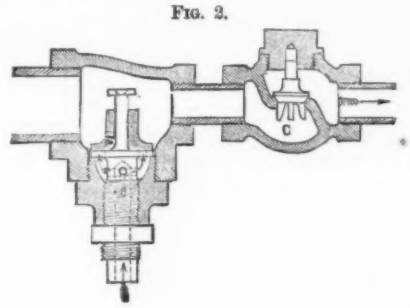


of water available, which, therefore, was assumed to be ample:

Height of fall	9	ft.	10 in.
Elevation of reservoir	63	"	10 "
Diameter of inlet pipe			11½ "
Length " "	52	"	4 "
Diameter of ascension pipe			5½ "
Length " "	127	"	8 "
Diameter of waste valve			11½ "
Contents of air vessel			4 9/10 cu. ft.

The capacity of the air vessel was increased to 5½ cu. ft., as the additional expense of the material was amply compensated by the known advantage of a large air cushion, in partially relieving this type of machine from the violent shocks inseparable from its action. The minor details and their disposition were determined upon by the constructors after consideration and information obtained by reference to Creecy, London *Engineer*, and Spon's "Dictionary of Engineering," wherein were found descriptions of several which, though of small capacity, were of assistance in forming a conclusion. The results were embodied in the machine, of

FIG. 2.



which the following is a description. A reference to the cut will make the construction more readily understood:

The body of the ram is a cylindrical pipe, 11½ inches bore and 1½ inch thick, strengthened with flanges. It curves upward at the rear or discharge end until the axis of bore becomes vertical, when the bore is enlarged to 19½ inches, so as to form a chamber for the waste valve. Several vertical ribs join the flange provided for the valve seat at top of chamber with the main body of the ram. About midway the length of the body is the seat for water valve and the air vessel. A horizontal flange on each side of the body, strongly ribbed, serves to hold the machine to timbers which rest upon stone foundations. Six bolts pass through all, with keys and plates at lower ends. The water valve is of gum, and seats upon a grating cast on the body of ram, and is held in position by a stud carrying a guard. This valve is incased by the air vessel, and access to it is had through a door. The body of the waste valve is of cast iron, strongly ribbed, and is guided at its upper end by wings sliding within the bore of valve seat, and at its lower end by a stem working in a hole bored in the body of ram. This hole is fitted at its lower end with a long tap bolt, which is used to adjust the drop of the valve and the number of beats per minute at such a point, found by trial, where best efficiency of ram is obtained.

A piece of gum interposed between the ends of stem and tap bolt serves to soften the blow of descending valve. The face of waste valve is a ring of wrought iron riveted to the valve, with three thicknesses of heavy sole leather between them, so as to give some elasticity, and thereby diminish the shocks given by the valve closing. The waste valve seat is of cast iron, made heavy (about five times the weight of the valve), and firmly bolted to the body of ram. The supply is carried through cast-iron pipes having socket joints, and their thickness diminishes from 1⅛ inch at the junction with ram to ⅜ inch at the upper end. The ascension pipe is welded wrought-iron tube, 5½ inches diameter, joined by flanges. The apparatus for supplying air to the air vessel is essentially that designed by Mr. Bolée (see Spon's "Dictionary of Engineering," article "Hydraulic Machines," folio 1972), with a modification of the "snifting valve," which compels all the air admitted through it to enter the air vessel; or if in excess, as in this case provided so, the surplus escapes between the under side of valve seat and the top of screw plug, on which the valve is mounted, through an opening adjustable by means of the screwed shank of the valve seat.

The supply air passes upward through the hollow shank, thence outward, through holes, into the space below the valve seat; the valve seat is perforated with several holes, through which the air rises and lifts the valve. When the valve closes the return of any air is prevented, but if the seat be raised from the top of the plug, a portion of it, more or less, as desired, passes between them and escapes (see enlarged view of snifting valve). The valve is placed high enough to be above floods, and its operation is as follows:

The tube, *a*, is of 1 inch gas pipe, and it rises, from the point of its attachment to body of ram, to a suitable height, and carries the snifting valve and a check valve; it is then joined by a ½ inch gas pipe, *b*, which descends and meets a check valve attached to the ram immediately under the air vessel. When the waste valve opens, the water contained in the pipe, *a*, falls and produces a vacuum, when the air enters through the snifting valve into pipe, *a*. When the stroke recurs and waste valve closes, the water rises in pipe, *a*, and displaces the air, which, under pressure, opens the check valve, *c*, whence it passes, through pipe, *b*, and check valve, *d*, into body of ram, and ascends into the air vessel. This occurs each stroke, so that supply of air is continuous. Any surplus is discharged by the modification before described.

Upon completion the apparatus was set up in position, and pipes attached—about 35 feet of ascension pipe, placed vertically, and 48 feet of supply pipe, connected with a tank holding enough water for five minutes' run, set 10 feet high (or the height of fall) above ram. Short trials were made, mainly to prove the work, and, if possible, to get adjustment of waste valve, giving best results as to quantity of water raised with least hammer of valve, but the limited supply of water, and the temporary manner in which the arrangements were obliged to be made, prevented any rigid tests, and, consequently, no results of value were obtained.

IMPROVED SCREW-CUTTING MECHANISM.

By E. P. BAVILLE and A. GREENWOOD, of Leeds, Eng.

HITHERTO, in cutting screws in dies, the action has been to impress a thread on the blank rather than to cut it by the removal of superfluous metal; and accordingly, instead of using segment-shaped cutting dies, they form their cutting tool from a cross section of a steel cylindrical screw tap or threaded plug, channeling it transversely to convert it into, say, four distinct cutters, each of which will possess two cutting edges.

In the drawings (Figs. 1 and 2) A is the screw stock or frame carrying the cutting tools, B, and provided with handles as usual for moving it around the work which is to be acted upon by the cutting tool. The breadth of the tools, B, is shown equal to the thickness of the stock, but this is not necessary for the proper action of the tools, although a good breadth is preferred, as it insures the more steady working of the screw stock. Each tool, B, is fitted into a slot or recess made transversely of the stock, and having the counterpart shape of the tool. This recess or slot is so situate with regard to the work to be threaded that one cutter of the four will project into the central space that the work is to occupy, and it is so arranged relatively to a central line drawn through the stock that the cutter will always be presented to the work in the best possible position for working—that is to say, instead of pressing out or indenting the thread as the work is forced into contact therewith, it will form the thread by a clean cut or removal of the metal like the cutting tool of a lathe. The cutter is secured in the stock by means of a transverse pin, *b*, the withdrawal of which will permit of the cutter being shifted to bring a fresh cutting edge into action.

In the simplest form of stock, in which one cutter only is used, the work is pressed up to the cutter by a threaded semicircular rest, which slides in guides in the stock, and is connected by a dovetail joint to a threaded socket, into which fits a screw, E, made fast to or forming a portion of one of the handles, which is fitted loosely to the stock, A, so that it may turn freely, and thereby advance or draw back the sliding rest. When the cutting edge has become dull the tool is shifted axially to bring the several cutting edges in succession into action, and when the forward edges of the four cutters have been thus used the tool is to be reversed, when four additional cutting edges may in succession be brought into action. For cutting screws of a better class the patentees prefer to use in one stock three tools, such as that described. This arrangement is shown in side view at Fig. 1, and in cross section at Fig. 2, where A is the stock, B are the cutting tools, and C is the work to be threaded.

STEAM IN WATER.

THIS is a theory based upon certain points, to which there can be no reasonable objection, and which readily accounts for the immense force and disastrous effects of boiler explosions. The points are as follows:

1st. That the vapor of water is a gas, and subject to precisely the same laws as govern other gases.

2d. That evaporation is unremitting, and takes place at all temperatures above zero of the absolute scale.

3d. That solids and liquids have the property of absorbing large volumes of some gases, with only a small increase in their dimensions. (A fact well known.)

4th. That the temperature of water, whether solid (as ice) or liquid, depends upon the amount of vapor in it.

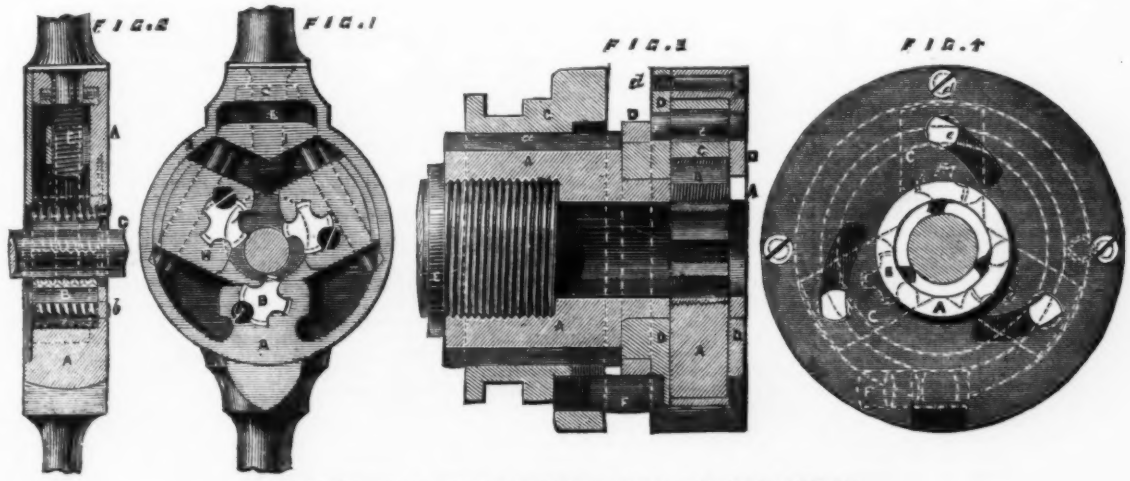
5th. That the capacity of water for vapor, or any other gas, increases with the pressure on it.

6th. When water is saturated with vapor at any pressure, an addition of heat will cause a rapid evolution of vapor, and the water is said to boil.

The absolute scale compared with the ordinary thermometer is, in Fahrenheit degrees, as follows:

ABSOLUTE.	ORDINARY.	
2086°	1626·6	Dry steam, sensible and latent heat.
1661·4	1202·0	Ordinary steam " " " "
671·4	212·0	Boiling point of water.
491·4	32·0	Melting ice.
459·4	0°	Zero.
0°	—459.4	Absolute cold, heat motions or oscillations entirely disappear, and the body is without heat.

Steam, like air, contains moisture, ordinary steam, or



IMPROVED SCREW-CUTTING MECHANISM.

* Journal Franklin Institute.

steam in contact with water, from which it is generated, consists, by weight, of 9·7 steam and 0·3 water. In the following calculations mathematical accuracy is not pretended, but simply an approximation to truth sufficient to illustrate the theory:

To bring water to the boiling point requires	671·4°
To convert it into ordinary steam "	990·0
To " " dry "	424·6
Total heat in water as a perfect gas.....	2086·0°

This perfect gas, at atmospheric pressure, is 2,400 times the bulk of the water from which it was made, and if 2086° make 2,400 volumes, 1° will make 1·15 volume, or for every degree Fahrenheit added to water it contains 1·15 times its bulk of vapor, and becomes saturated or contains all the vapor it will hold at atmospheric pressure, at a temperature of 671·4° absolute or 212° by the ordinary scale, and as heat is added the vapor escapes so rapidly that it produces ebullition and the water is said to boil; in an open vessel large quantities of vapor escape, on account of its small specific gravity, but if the water be confined so that no vapor can escape, it becomes satufated or heated to 212° in a remarkably short time. The amount of vapor in water can be found by multiplying its absolute temperature by 1·15; the absolute temperature is 459·4° more than that indicated by the thermometer.

At 32° ordinary or 491·4° absolute, melting point of ice, water contains 565 times its bulk of vapor; at 212° ordinary or 671·4° absolute, water is saturated with vapor or has all it will hold at atmospheric pressure, or 772 times its own bulk. The capacity of water for vapor increases with the pressure; for instance, at 10 atmospheres, or 147 lbs. to the square inch, the temperature of water is 358° ordinary or 817·4° absolute, and it absorbs 817·4×1·15=950 times its bulk of vapor.

The power of water to absorb a gas is remarkably diminished by the presence of even a small quantity of air; it usually contains about 2 per cent., and it is to the air in the water that its refreshing taste is in a great measure due; if all the air be expelled by boiling the amount of vapor it will absorb is surprising.

Professor Donny, of Ghent, observed that water thoroughly deprived of air and sealed up in a long glass tube at atmospheric pressure could be heated to 280°, a temperature corresponding to 3·5 atmospheres. The evaporation was then sudden, and the water was violently thrown to the other end of the tube. (Watts' Chemistry.)

280° equals an absolute temperature of 739·4°, which multiplied by 1·15 gives 850, and shows that water deprived of air has its capacity for vapor increased from 772 to 850 times its bulk at atmospheric pressure; on the slightest disturbance these 88 extra volumes of vapor will escape suddenly, carrying the water with them with great violence.

This can easily occur when a large boiler is used for a small supply of steam, or when any boiler is standing for some time with a fire in the furnace and the steam not being used. Another source of danger is oil in the boiler. If the surface of a liquid be covered by another which has a higher boiling point, such as oil, it may attain a temperature higher than its boiling point, or, what is the same thing, contain more vapor than the pressure on it warrants.

The vapor is absorbed by the water and stowed away in its intermolecular spaces in the same way that other gases are (for instance over 1,000 times its bulk of ammoniacal gas), with but a slight increase in its dimensions, called expansion; or as platinum takes up and stows away 500 times its bulk of oxygen.

Evaporation is unremitting, and in a boiler the space above the water is always filled with vapor; the thermometer indicates no difference of temperature in the vapor above the water from that in it, although the latter is, at atmospheric pressure, 772 times more in the same space than the former.

In many works on steam it is stated that one cubic inch of water will make 1,700 cubic inches of steam (only 0·7 of this, however, is steam), and that this steam will raise 5½ cubic inches of water from 32° to 212°; it is generally supposed that the steam is in this operation converted into water, and that there remain nothing but 6½ cubic inches of water, but in reality it is absorbed by the water, each volume of water absorbing its 210 volumes of steam, which added to what it contained before at 32° degrees, would saturate it or bring it to 212°; if as soon as the 5½ cubic inches have reached 212°, they should be poured into a flat, shallow dish, or the escape of the vapor be facilitated in any other manner, the steam will be seen to escape in large volumes and the water be found to have gained very little in weight, which proves conclusively that this large body of vapor was absorbed by and held as vapor in the 5½ cubic inches of water, and that the thermometer indicated the same temperature when it was compressed in the 5½ inches of space as when it occupied the 1,700 inches.

On this theory the disastrous effects of boiler explosions are easily accounted for.

The locomotive boiler, with 5,000 pounds of water, has 930 cubic feet of steam stowed away in every cubic foot of water; the factory boiler, with 20,000 or 30,000 pounds of water, holds 880 times as much steam as water below the water line; the marine boiler 842 times as much steam as water.

So long as the pressure can be made to correspond with the amount of steam in the water there is no danger. A cup of water at 212° is perfectly safe at the level of the sea, but let a person holding it be instantaneously transferred to the top of Mont Blanc, he would find himself enveloped in a cloud of hot steam and water, and witness, on a small scale, what occurs when a boiler bursts and the pressure on the water is suddenly diminished.

If steam be allowed to accumulate in the water, either from lack of air in it or from grease on top of it, it will escape bodily and with great violence on the slightest disturbance, even so slight as that caused by the opening of the safety valve, and bring a sudden and great strain on the boiler, sometimes sufficient to burst it, and immediately reduce the pressure to that of the atmosphere, allowing the immense quantity of steam in the water to escape bodily and carry with it from 5,000 to 60,000 pounds of water with a velocity greater than that of a cannon ball. Is not this sufficient to account for the force and destruction of a steam boiler explosion?

Users of steam should be familiar with its dangers and know what precautions to take as much as persons who have the care of gunpowder. Under some conditions both are perfectly safe, and equally dangerous under others.

All steam boilers should be provided with some kind of thermometer to indicate the temperature of the water and show when there is a dangerous amount of steam in it, and it should be so arranged that the expansion of the liquid used would open a cock near the bottom of the boiler and let the water into the furnace to extinguish the fire when the water becomes heated above the safety point. It would be exceedingly dangerous to even open the safety valve when the water contains more steam than is due to the pressure on it.

Linseed or olive oil, inclosed in tubes, would answer well for a thermometer; their specific heat is low, expansion great, and boiling point high. The pressure scale should be graduated to the expansion of the oil, and the difference between the pressure shown by it and that shown by the steam gauge would indicate any excess of steam in the water.

G. B. M.

60 Devonshire street, Boston, Mass.
November 26th, 1878.

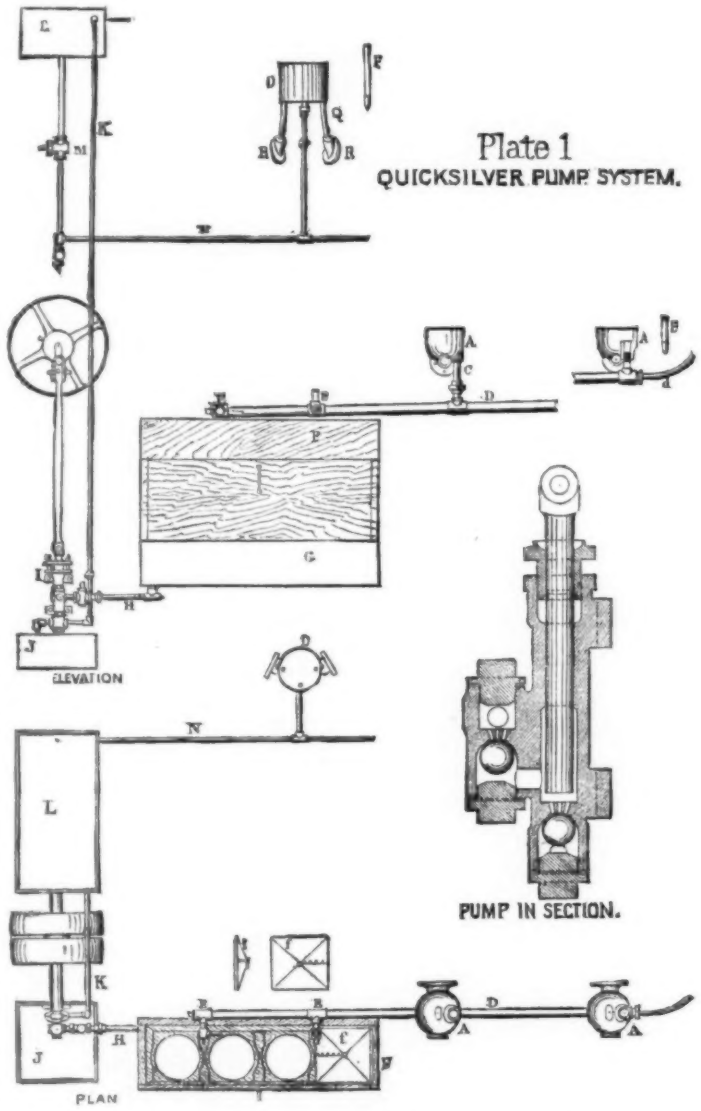
THE SILVER MILL.

By M. P. Boss.

DEDUCTIONS FROM PRACTICAL EXPERIENCE.

IRON producers, scientists, and railroad engineers have their societies for mutual benefit. Minute details of facts and forms which they develop conduce to general improvement. But no society of practical, actual workers in mining and metallurgy, as developed in the United States, exists to accumulate and retain, from their several experiences, those minutiæ so essential to the maximum of economy and success.

From a lack of correct, minor details, the apparently superior mills do not always obtain the best results; and often from an old rattletrap mill most excellent results are obtained,



The causes are generally simple, but not always easily found, even by an experienced and observing millman.

It is often very convenient to lay the blame to the "peculiarities of the ore," when it may not belong there.

For an illustration of how deficiency in details may effect needless expense, mention may be made of a mill of recent manufacture and assumed to be first class in every respect. Although the intention was to grind the ore in the pans, the mullers and drivers were remarkably and unnecessarily heavy.

For the sake of exact figures, we will suppose this mill to be set up at Virginia, and working bonanza ore.

A set of shoes and dies would weigh about 1,400 pounds; at 5¼ cents, the cost would be $73.50. The value of the old iron left, after the set was worn out, would be less than $7.50, leaving a loss of $66.00. With mullers of minimum weight, the best average wear of castings is less than fifteen days; the excessive weight would grind them out three days sooner, a difference of $13.20, or nearly $1.00 per day; and these figures are where castings are the very cheapest.

Owing to the scattered and ever changing mining activities, with their unsettled and uncertain futures, and to the intoxicating effects of stocks, it is pretty certain that no mining society could enthuse a sufficiently interested membership; and the only authority available must continue to be, the men and builders, who chance to be selected to accomplish the desired results, be they better or worse. However, Americans need not be ashamed of their progress or status.

The prospecting miner who can extract good, free milling ore, can provide himself with machinery, of the capacity of 3 or 4 tons per day, with very little outlay, but he must be cautious not to drift into that error which has left so many wrecks, viz.: the forfeiture of a success to an experiment.

It is commendable for those who can afford it to carefully experiment for improved methods. It is the life of progress.

But for milling on a more extended scale, for the greatest profits, heavier capital is requisite, and nothing more strongly emphasizes the saying, "the best is always the cheapest."

For the milling of raw ores two methods may be said to exist, which involves little difference in the mills, save the relative proportion of power, stamps, and pans.

The older and more familiar method is to crush coarse in the battery and grind in the pans. This involves greater power, greater wear of castings, and greater loss of quicksilver, and not always, better results.

A more recent, but not so universal method, is to crush fine in the battery and to keep the shoes barely off the dies. It may seem incredible that by the latter means more gold and silver may sometimes be extracted than by the former. Ore will naturally break where there is the most mineral, and from a fine comminution in the battery, the mineral will be nearly all disengaged. Quicksilver has a preference for gold and silver; but in grinding it is forced to take up base, which renders it inactive for the more precious metals. Result, more bullion and less value.

It is a matter of doubt whether, taken all in all, there is an instance where amalgamation without grinding might not equal the more expensive grinding.

Comstock ore is always ground, but they never have exhaustively experimented otherwise. Again, fine crushing increases the percentage of slimes, and the system of working them separate (the sand for the Mine Co., which must not return below a given per cent., and the slimes for the Mill Co.) makes it difficult to render the required returns to the mine.

The query might arise, "Would not the slimes exceed the ability to handle them?" Very little sand worked with the slimes before they have much hardened will cut the cohesion, and it is the cohesiveness in slimes that carries the quicksilver, and that cohesiveness, once established, brings all the difficulty of working them.

Of the two methods, a compromise ground is untenable. It is a fact, well known by the experienced, that when thoroughness of grinding is wanting, returns are also. This has been thought a proof against not grinding, but the latter is not to be judged when fine crushing has been compromised.

In a proper conditioned pan pulp once between the shoes and dies would be sufficiently ground, but the amount is so small that it takes a long time for the mass to make the circuit; and to stop when half done would be no better than to alternate grinding one charge and not another.

CRUSHING.

Countless have been the devices for crushing ore, but that primary crushing device used by all aborigines, the stone mortar and pestle, as developed into the modern ponderous stamp battery, stands as prominently in the van as ever.

As a preparatory for the stamps the rockbreaker is generally a necessity. Of the various styles, so far as introduced,

the Blake is so much the best that none other is to be considered in comparison with it.

Self-feeders, in their present perfection, not only make their advantage a saving felt on the pay roll, but increase the efficiency of the battery, and are a saving in the wear of castings. Three kinds are at present prominently in the market, all of which are now under the same control, and the buyer's choice is unbiased by rival owners.

Of these the Hendy feeder has been the most ably introduced, having passed other "jerky contrivances" in the lead. This feeder has generally given good satisfaction, especially in wet, sticky ores. Some fine dry ores, however, have a tendency to jar off, a circumstance that precludes precision.

The Tullock has for years fed the wet ores of the Comstock with satisfaction, and possibly a case of their failure anywhere might reflect as much on the millman as on the machine.

The Standard as now improved is the simplest of feeders, and in dry ore probably unsurpassed.

Stamps are now made heavier, and are run faster than formerly; a modern stamp rarely weighs less than 800 lbs., and a stamp that makes no more than 90 drops per minute is counted slow. (The California Mill, Virginia, makes 102.) The wear and tear of a high speed battery of course is more, but with it much more work is accomplished. It is important, for economic wear, that a stamp should commence to rise as soon as its force is expended; furthermore, that its rise should be with accelerated velocity; in other words, the cam should be so formed that the first degree of revolution after contact should raise the stamp less than the last degree before dropping, and the curvature of the cam should be as great as possible, and admit of the drop. Of course this can be only at the maximum drop.

AMALGAMATION.

In amalgamation, as in crushing, the popular process is one of many.

The modern amalgamating pan is a growth from the old arastra, and though quite simple in construction, has been the subject of a variety of forms. A better knowledge of what they can and should do, has narrowed these down to common generalities. The pan holds from one and one half to two tons of pulp; the gearing underneath is open and plain; the muller is raised by a left-hand screw on top, the handwheels of which should be large; the jam wheel being no smaller than the screw wheel from the fact that at times it is the subject of even greater application of muscle than the latter. Again, when in fast motion it is decidedly inconvenient to adjust a small wheel under a larger one.

As the muller and driver are held to position by but one bearing, it is strange that the inclination has been to make this short. Eighteen inches is none too long for the bore of a driver, and the shaft should pass entirely through it when the castings are new, provision being made in the cap for the end of the shaft when the castings are worn.

Much time and labor are saved in Babbitting the shaft, if it is made with a taper downward through the Babbitt; in which case, instead of withdrawing the shaft and cutting the old Babbitt, new Babbitt is poured with the old, the taper preventing displacement even if the new Babbitt becomes broken.*

But the most important feature of a pan—one which may involve many dollars per day, but which often receives but little attention, and, though simple in principle, is very often not understood because not studied—is the pulp currents.

These currents must needs be uniform and regular to insure uniform work, and they must be strong enough at the bottom of the pan to carry the quicksilver. The motion of the muller makes a current by throwing the pulp to the outside as it advances, which then rolls up at the side and over to the center to be thrown out again. This, so far, cannot be improved upon, and the only service left for the wings is to add to the pan capacity by preventing the pulp from running too high up the sides, to accomplish which the best shape is of an inverted plowshare. Having very naturally a good current above the muller, we have only to work in unison with this underneath.

With the grooves between the shoes leading straight out, the current is impelled only by centrifugal force, which is insufficient to carry the quicksilver; but if the point of a shoe touches the diameter, its outer end being a very few inches either forward or back, a current is forced proportionate to the angle of departure from the given diameter. If the dovetails in the muller and pan bottom are relatively similar, to admit of the shoe and die being one and the same pattern, the currents of the two will be similar and in unison. When the currents are outward they coincide with that above the muller, inward currents being the reverse. A confusion of the two—unless one strongly overbalances the other—effects stagnation. It does not follow that because an inward current works contrawise to the one above the muller, it cannot do good work; if it is strong they will compromise.

Definite rules for the angle of drought for shoes and dies cannot be laid down, because the speed of pan, the character and thickness of pulp, and, if grinding, the weight of muller, have each their influence.

It must rest with the millman to determine if the mechanical part of his amalgamation is perfect, or if his quicksilver is churned, or his castings cut out too quickly. A remedy is at hand, if systematically sought.

The speed of pans, a few years ago, was generally sixty or sixty-five revolutions per minute, eighty-five or ninety is more common now. With the slow motion the pulp should be thick, with the fast motion much thinner, and the charges of the latter are worked much sooner. A modern mill with fast batteries and fast pans accomplishes much more than the slow one of old.

The screw on the settler driver should, unlike the pans, be right handed, for besides being more convenient in case of a slipping belt, the power applied to turn the screw helps the muller along.

Settlers are of two classes, one having mullers with wooden shoes, and the other having arms with either wooden or iron shoes or stirrers.

For heavy, underground sand, the muller is easier to start and less liable to clog, and is more commonly used in such cases; but for well ground sand the other style is superior.

A settler should never be allowed to foul by an accumulation of heavy matter at the bottom; it is a positive preventive of good work. It may seem easier to advocate this than always to follow it.

A seeming natural remedy for such a condition is really an aggravation of it, namely, a liberal use of water. There is a point in the thinning when the quicksilver will be precipitated, but the heavy sand held in suspension.

If, after the charge is run out, which should leave about eight inches in the settler, a pan is drawn and no water added for a half hour, the warm charge will gather and carry the heavy sand; now enough water, only, is added to reduce it to an appearance of still some thickness, and this is all the water that is used in the charge. A horn spoon will show its success in advance of results.

Concentrators for a silver mill must necessarily be simple and capacious. Good agitators, shoveled out often, are profitable.

In some ores "sand sluices" are very effectual. A "sand sluice" for concentrating is a broad sluice twenty or twenty-four inches wide, and in it, at intervals of eight or ten feet, are vertical strips at the sides to hold unfastened riffles. Thin riffles are laid in and the sand runs over them for a time, say one or more hours, when another course of riffles one half inch, or less, thick, is laid on top of the others. This is repeated until the sluice is full, when it is shoveled out; meantime the sand should run through a duplicate sluice. These sluices should have a grade of about three and one half inches to the rod, it is then under control; for by starting with a thin riffle at the bottom, a strong current may be had, whereas a thick riffle will give a deadened current.

These sluices are an advantage where blankets are profitable, and if followed by blankets relieve the latter from much coarse, heavy material.

A blanket sluice should have a grade of about three inches in seven feet.

QUICKSILVER.

Quicksilver is lost both mechanically and chemically, and eternal vigilance is required in both directions.

The handling of quicksilver, when it is not in direct intercourse with the pulp, has its importance on the score of economy. Consequent upon continued lifting and carrying heavy quantities by the old method of hand labor, was a not insignificant loss.

Partly in proof of this is the bonanza of quicksilver an old mill is known to be.

To save this, and the heavy lugging by hand labor—which if the amount was expended upon water would seem immense—was attempted years ago by way of mechanical substitutes. To contend with was the heavy weight of the liquid and its close connection and relation with air, water, dirt, and amalgam, each of different gravities.

It has been well proved that a poor device for handling quicksilver is even more extravagant than hand labor.

At one of the Raymond & Ely mills an elevator was put in, but after much bother and trouble was discarded. Later a quicksilver pump with downward working valves was tried. Illustrative of its success was its rapid introduction into other mills.

Yet as a complete system it still had some drawbacks, and the study from time and experience was required to develop its perfection—for it must continue to do its work without any special attention, and for unskilled hands.

Plate I. shows the arbitrary generalities which must be observed to obtain superiority.

Plate II. shows another system, perfected later, which is especially good for a small mill, as the expense is very light even for only two pans. At the Con. Va. & Cala. Mills the pump system is mainly employed; but for the single agitator pans the pressure system does the work.

QUICKSILVER PUMP SYSTEM.

The settler bowls, A, have a vertical discharge at one side; said discharge is four inches above the inlet, and one inch above the bottom of settler (inside), and is fitted for a wooden plug, B.

A one inch pipe, C, connects the discharge to a one and one half inch pipe, D. This pipe, D, has an incline of one inch in four feet, and at the upper end a small pipe (d) connects with a steam pipe for an occasional clearing out.

At the lower end of this pipe the strainers are situated. Short one inch pipes, E, may be turned to either of two strainers, and discharge on sheet iron covers (f). These covers may be locked by passing a rod over them.

Strainer box, F, is of wood and contains four strainers. It is fitted to the top of a cast iron tank, G. Tank G is five feet long and one and a half wide, and one foot deep. Through the bottom of G a short one inch pipe connects to the pump, I.

The pump has a stroke of five inches, and makes forty per minute. The plunger is of steel, and the packing is $\frac{7}{8}$ inch round rubber, to prepare which it should be dropped into melted tallow and wiped dry before cooling; this dispenses with oil on the plunger.

Around the plunger, below the stuffing box, is a recess into which water rises, making a hydraulic packing below the rubber. Rubber gasket $\frac{1}{8}$ inch thick is used on the plugs.

A tank, J, stands under the pump to catch leakage. The pump should run only when throwing. The valves being of rubber and seating easily, and the plunger running in hydraulic packing, leaves no possibility for any grinding effect on the quicksilver.

The pump discharges through a $\frac{3}{4}$ inch pipe, K (this pipe should be well supported near the pump), into an upper reservoir, L. This reservoir stands on a frame work, twenty inches above the pans. The vertical discharge is one inch pipe for eighteen or twenty inches, down to a quicksilver cock (cast iron, with a stuffing box), M. From this cock the distributing pipe, N, is $\frac{3}{4}$ inch, leads in front of the pans, and may conveniently be on the floor (being protected by wooden strips on each side). At the lowest place in this pipe provision must be made to allow drainage into a settler, or to the reservoir below.

Between each of two pans a branch of pipe, N, enters the bottom of charging bowl, O.

Before entering the bowl the pipe is enlarged to one inch to accommodate a better size of wooden plug, P.

Charger, O, is of cast iron, stands seven inches above the top of the pans, and is supported by two stand pipes, Q (one inch), which connect to the pans by flanges, R. These flanges, for iron side pans, are bolted to the outside and stand at an angle of 60 degrees or more.

Flanges for wooden pans are shown in plate I.

A belt shifter for starting or stopping the pump should be operated from near the upper reservoir.

QUICKSILVER PRESSURE SYSTEM.

A A are one inch pipes from the settlers (no bowls are used). The discharge is $3\frac{1}{2}$ inches, or more, higher than the connected end, and one inch higher than the top of settler bottom. Strainer tank, G, is of cast iron, $1\frac{1}{2}$ feet square by one foot deep.

Pipe E, near the top, is an overflow for water. H is a one inch pipe connecting through bottom of tank, G, to pressure chamber, I. Quicksilver cock, D, is operated by a lever, extending above the strainer for convenience of access.

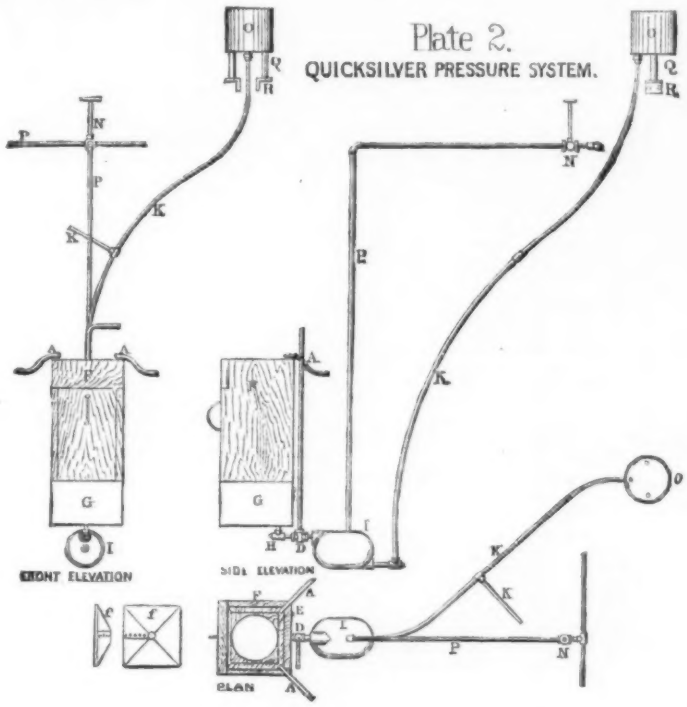
Pressure chamber, I, has a capacity of a full charge of quicksilver.

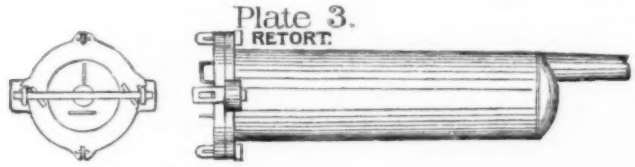
P is a half inch pipe connecting to steam or mud drum of boiler, or to natural water pressure, or to compressed air. Valve, N, should be convenient to charging bowls.

At the bottom of I a three quarter inch pipe, K, branches and enters through the bottoms of two charging bowls, O, thus supplying four pans.

For wooden sided pans, flanges, R, bring the stand pipes, Q, on the top end of the staves.

In action cock, D, being open, the quicksilver will flow naturally into chamber, I, then by closing D and opening pressure valve, N, the quicksilver will be forced through pipe, K, into bowl, O. Six pounds pressure will raise quick-





* A late adaptation of Mr. Armstrong's, of the California and Con. Virginia Mills.

silver one foot. In case of a watermill, where the pressure may not be sufficient, an extra chamber, I, may be introduced half way to bowl, O, which will be self-acting.

After the piping is well put together it should be first tested with water.

The burr, from cutting the pipes, should be reamed off.

AMALGAM.

A pan for scouring amalgam resembles a small settler, but should have attached to its arms a shoe extending from rim to cone, the outer end being five or six inches ahead.

Diameter of pan, 5 feet; depth, 1½ foot; speed, 25 per minute. Before retorting, the amalgam should be dried by a hydraulic press or by piling the amalgam some two feet high on a strainer, and allowed to drain for a couple of hours.

The choice of retorts is not of vital importance to success, but as a question of convenience and economy it is to be considered. The hooded central discharge retort, which admits of turning, was extensively introduced and is still largely used outside of the Comstock, where they are almost if not entirely discarded.

As a center discharge does not admit of being filled, a much smaller retort with top discharge will do equal work, for which due compensation is not given, by the turning of the former. In other words, the consumption of iron for a given amount of amalgam retorted is greatest with the center discharge. These are deductions from personal observations, where individual weights and number of charges were recorded, and was extended to several working side by side. The average life of a center discharge retort 14 inches by 5 feet, by 1½ inch thick, was under 35 charges.

The hood and the head with revolving bar attached to its center is doubtless the cheapest form of construction, but for large retorts decidedly inconvenient, and invite a bad job in adjusting the head.

A decided and unprecedented success was made, two years ago, by casting retorts on end, face up, rendering the metal dense and uniform.

Eight retorts cast in this way, of a plan similar to plate III., were made for the Brunswick Mill. They were 5½ feet long, 14 inches inside diameter, and 2 inches thick.

With charges varying from nineteen hundred to twenty-four hundred pounds, they endured upward of eighty-five fires. Compared with the previous average, the advantage is emphatic, the extra thickness of one half inch requiring no appreciable increase of fuel.

To avoid the hard labor of cutting the bullion of a large retorting, use paper to make divisions in the amalgam instead of sheet iron.

Quicksilver melts at —39°, evaporates slightly at ordinary temperatures, and boils at 662°. Its specific gravity is 13·6 at 32°.

2·038 cubic inches weigh 1 pound.

One cubic foot weighs 847·89 pounds.

In a column of quicksilver every foot in height gives a pressure of 5,888 pounds per square inch. That quicksilver will pass through a smaller aperture than water is a popular fallacy, naturally deduced from the fact that the former will often leak from a vessel that will hold the latter. An explanation for this seeming paradox is that quicksilver, being so much heavier, gives far greater pressure, and in wooden vessels, water, having the finer penetration, enters the fiber of the wood and swells it, thereby closing small openings, whereas quicksilver, entering only the open grain, has no expanding effect.

Gold melts at	2,016°,	its specific	gravity	is		19·3
Silver	" 1,873°,	"	"	"	"	10·5
Copper	" 1,996°,	"	"	"	"	8·9
Cast iron	" 2,786°,	"	"	"	"	7·8
Lead	" 612°,	"	"	"	"	11·3

1 oz. Troy of silver is worth		$ 1·2929
1 lb. " " "		18·854
1 ton " " "		37,709·50
1 cubic foot " "		12,355·20
1 oz. Troy of gold is worth		$ 20 6717
1 lb. " " "		301·46
1 ton " " "		602,927·36
1 cubic foot " "		361,808·64

3·89 cubic inches cast iron weigh 1 lb.

To compute the weight of an article of

Cast iron, multiply its cubic inches by	0·2607 lb.
Wrought iron, multiply its cubic inches by	0·2816 lb.
Copper, multiply its cubic inches by	0·3212 lb.
Lead, multiply its cubic inches by	0·4102 lb.

Under a column of water 26·5 inches high there is a pressure of 1 pound per square inch.

A circumference equals the diameter multiplied by 3·1416.

The area of a circle equals one half of the diameter multiplied by one half of the circumference, or square of the diameter, multiplied by 0·7854.

The surface of a sphere is the circumference multiplied by the diameter.

The volume of a sphere is the cubic of the diameter multiplied by 0·5236.

TENSILE STRENGTH OF RODS PER SQUARE INCH.

Cast steel,	breaking load,	50	tons;	safety load,		12·5	tons.
Swedish iron,	" "	36	"	"	"	9·0	"
Common iron,	" "	28	"	"	"	7·0	"

STRENGTH OF ROPES.

Let C represent the circumference:

New hemp will safely sustain..... $\frac{0{\cdot}4\ C^2}{6}$ tons.

Iron wire will safely sustain..... $\frac{2{\cdot}6\ C^2}{6}$ tons.

Steel wire will safely sustain..... $\frac{3{\cdot}75\ C^2}{6}$ tons.

RUST JOINT CEMENT (QUICK-SETTING).

1 lb. sal ammoniac, 2 lbs. sulphur, 80 lbs. iron filings. Mix to a paste with water.

Slow-setting—2 lbs. sal-ammoniac, 1 lb. sulphur, 200 lbs. iron filings.

For holes in castings, take 1 part gum arabic, 1 part plaster Paris, and 1 part iron filings. Mix with a little water.

Babbitt metal, 3·7 copper, 0·89 tin, 7·3 antimony.

Metal that expands in cooling—Lead, 75 parts; antimony, 16·7; bismuth, 8·3.

Taper for keys for shafting—One-sixteenth inch to four inches.

DECIPIUM—A NEW METAL FROM SAMARSKITE.

By M. DELAFONTAINE.

WHILE prosecuting my researches on the samarskite earths of North Carolina, I discovered in them a new metal, which I have called Decipium (from *Decipiens*). This metal, which possesses the properties common to those of cerite and gadolinite, forms an oxide, the equivalent of which is approximately 122, its formula being DpO (or Dp_2O_3=366).

I have not yet effected the separation of this new metal from didymia completely enough to affirm that its color is white. Its salts are colorless; the acetate crystallizes very easily, and seems to be less soluble than that of didymium, but more so than that of terbium. The decipio-potassic sulphate is only slightly soluble in a saturated solution of potassic sulphate, but dissolves easily in water.

The nitrate of decipium gives an absorption spectrum, composed of three bands at least, in the indigo and blue. In order to see them well the aid of sunlight is necessary, the best way being to direct the slit of the spectroscope toward the disk of the sun, interposing a piece of blue glass before the eye piece. The most refrangible ray is a little narrower than that of philippium and the *m* of didymium. It is rather dark; its middle closely corresponds to the wave length 416, or to 195 of M. Lecoq's scale. It is nearly in the middle of the space between Fraunhofer's lines G and H, but more nearly approaches G. Neither didymium nor terbium gives any ray in this region. The band which characterizes terbium is hardly so broad; it is seen more to the right, and is so near to the limit of the spectrum which I obtain with my instrument that an intense solar light is necessary in order to clearly distinguish it. In exceptional conditions of light I have been able to observe the violet space beyond, and to recognize in it two well defined rays, which are probably H and H′.

The second band of decipium is narrower, more intense, and a little indistinct at the edges. It is seen in the less refrangible blue; its middle corresponds very nearly to the wave length 478. It is nearly in the same place as a band of didymium, but its intensity is incomparably greater. More to the left, and nearer to the limit of the blue and green, there is a rather indistinct minimum of transmission, which may be the result of the overlapping of the two faintly defined bands. I have not, however, succeeded in separating them. I intend to return to the subject shortly.

In the present state of my knowledge I recognize in the samarskite earths of North Carolina (more or less combined with other earths) the following:

Name.	Color.	Equivalent.	Characteristic Absorption Band.
Yttria	White	YO =74·5 (Delafontaine)	None.
Erbia	Rose	ErO =130 (Bunsen, Clève)	520 to 522
Terbia	Orange	TbO =114-115 (Delafont., Marignac)	About 400
Philippia	Yellow	PpO =about 90 (Delafont.)	" 449
Decipia	White?	DpO =about 122 (")	416
Thoria	White	ThO_2=267·5 (")	None.
Oxide of didymium	Brownish	DiO =112-114 (Marignac, Clève)	572 to 577
" of cerium	Pale yellow		None.

The equivalents* of the metals contained in some of these earths show rather interesting numerical relations to each other:

Yttrium	58
Philippium	74 or 58+2×8
Terbium	98 or 58+5×8
Decipium	106? or 58+6×8
Erbium	114 or 58+7×8

If the above metals are considered as triatomic, the difference will be 12, or one of its multiples, instead of 8.—*Comptes Rendus.*

* This term is employed until the true atomic weights have been accurately determined.

NEW IMPROVEMENTS IN PLATINOTYPE PRINTING.

As would have been seen from the transactions of the recent meeting of the British Association, the platinum printing process of Mr. William Willis, Jr., which was described three years ago in the *British Journal of Photography*, has been subjected to further modifications, the alterations that have been made having the important effect of greatly simplifying this process. Previous to describing the details of the improved method—which were not given in the paper read before the British Association—we shall first present an outline of the process as formerly practiced, with an account of the chemical changes produced.

A sheet of smooth and plain paper having been partially excited by being floated for a short time upon a three-grain solution of nitrate of silver was, after being dried, washed over with a mixture of ferric oxalate and chloro-platinite of potassium, which, having been poured upon the surface, was distributed by means of a pad of cotton wool. The paper, sensitized in this manner was afterwards dried and exposed to light, in the printing-frame, the exposure given being only one-sixth of that which would have been required to produce an image upon silvered albumenized paper. When withdrawn from the pressure-frame the paper was immersed for a few seconds in a solution of potassic oxalate, followed by similar treatment—first, in a weak bath of solution of oxalic acid, then in a sulphocyanide of gold toning bath, and, lastly, in hyposulphite of soda followed by water.

In the improved method of carrying platinotype printing into effect the preliminary wash of nitrate of silver has been entirely dispensed with. There were two reasons for its adoption:—One was that through the agency of the subsequent toning bath a warm tint might pervade the finished picture. Another was that when it was made use of the image was found to be more thoroughly attached to the paper—sunk, as it were, in its meshes—than was the case when no such argentic treatment was had recourse to. *Why* it exerted such an influence upon the deposition of the platinum was never very well understood. Nevertheless the fact remained as has been stated. The withdrawal of the silver as an element in the preparation of the paper was of course attended by the simultaneous withdrawal of the sulphocyanide of gold toning bath, and also that of the hyposulphite of soda, neither of which existed save as adjuncts to the primary employment of the silver. The chemistry of the silver, the toning, and the fixing may, therefore, be expressed as follows:—The platinum image (of the formation of which we have not yet spoken) was of a black color; conventionalism demanded that all photographs be warm; a little silver, followed by warm toning, gave a sop to conventionalism; and hyposulphite of soda was the fitting wind up to the employment of the silver. But all this has been changed.

We shall now describe the process as we saw it carried out on the occasion of a visit we paid last week to the laboratory and *ateliers* of Mr. Willis.

A sheet of plain paper—plain in the sense of its having neither been albumenized, silvered, nor salted in any way—was laid down upon a large slab of glass, which was placed in a horizontal position. By convenient clips the paper was secured at the corners. The windows of the room, we may premise, were fitted with yellow blinds. A small quantity of a sensitizing fluid was poured upon the center of the paper and spread over its surface. The sensitizing fluid was composed of—

Ferric oxalate	60 grains.
Potassic chloro-platinite	15 "
Plumbic chloride	2 "
Water	1 ounce.

Why the lead salt in the above formula has been imported into the process we are not absolutely certain, unless it be that it helps to give the image, produced at a subsequent stage, a stronger hold of the paper than would be the case were it omitted. At any rate it seems to fill the place of the now discarded nitrate of silver in an effective manner. This solution is spread over the surface of the paper by means of a flannel squeegee, formed by bending the fabric over a piece of India-rubber tubing placed upon the edge of a slip of plate glass. The paper is now hung up to dry, and as soon as all surface moisture has disappeared the drying is finished before a stove or fire. The paper is now ready for exposure under a negative; it may either be used immediately or it may be kept until it is convenient to expose it, for it possesses excellent keeping properties. Prints have been obtained a month after the preparation of the paper, the quality of these being such as to indicate no difference whatever between them and prints upon paper freshly prepared. This is a valuable feature, and one which photographers will not be slow in appreciating.

The exposure under the negative is about one-third of that required in the case of albumenized silvered paper; in other words, it possesses three times more sensitiveness than ordinary albumenized paper. Although a *visible* image is provided by the action of light, it is found that the duration of exposure is more easily determined by an actinometer than by the inspection of the image. It may be recollected that in the account we gave of the original process three years ago we stated the sensitiveness to be five times greater than that o falbumenized silvered paper. This was the case, but the increased sensitiveness was owing to the presence of silver on the paper, and as this material is not now used the diminution of the sensitiveness is thus accounted for. However, as we have seen, it is still much more sensitive than ordinary silvered paper.

While the paper keeps well previous to being printed upon, it also keeps for a considerable period afterwards, or previous to development. The time of the operator may, therefore, be wholly bestowed during the day upon the printing, reserving the development till the light has deminished to too great a degree to enable the printing to be continued.

To develop the image a bath must have been prepared in the following proportions:—

Potassic oxalate	120 grains.
Potassic chloro-platinite	7 "
Water	1 ounce.

This solution is placed in an enameled iron dish, and strongly heated by means of a Bunsen gas burner placed underneath. Previous to immersing a print in this solution let us inquire what change has taken place in the paper by the exposure to light, so as to ascertain the functions of the developing solution.

The paper, it will be remembered, was coated with a solution of *ferric* oxalate combined with a solution of potassic chloro-platinite. Now, the former exerts no action whatever upon the latter; but upon being exposed to light it is converted into *ferrous* oxalate, which is a reducing agent for platinum. When, after exposure to light in the printing-frame, the picture is examined it is feebly though distinctly visible, although up to this stage the platinum has not taken any part in the performance. The visible picture is composed of ferrous oxalate, and it would have been equally visible had no platinum been present.

We have now to consider in what manner the ferrous oxalate which has been formed by the light is made to act as a reducing agent for the platinum. Before it can do so it must first be in solution, as no chemical action takes place between two bodies unless one of them be in a liquid form. So far as we know there is only one solvent for ferrous oxalate, namely, potassic oxalate; hence the print is drawn over or brought into contact with a solution of this salt, the result being an instantaneous reduction of the platinum with which the ferrous oxalate was in immediate contact. Up to the instant when the potassic oxalate is applied the atoms of the two agents are side by side in the paper, the ferrous oxalate being held in check, so that is incapable of reducing the platinum, until it is itself first acted upon by a solvent. No sooner, therefore, is the print placed in contact with such a solvent—in this case potassic oxalate—than the solution, simultaneous with its formation, attacks and reduces the platinum salts with which it formerly reposed harmlessly. The image is thus formed of metallic platinum—or "platina black," as we have sometimes heard it designated—which is well known to be one of the most stable substances in nature.

As far as the image is concerned the print is now finished; but in order to get rid of the salts in the paper it is washed for about five minutes in a bath containing a very small quantity of oxalate acid and a few drops of nitric acid. Subsequent immersion in about three changes of plain water, taking altogether about half an hour, completes the operation.

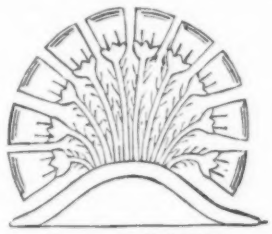
Prints produced by the process described are exceedingly durable. They have been subjected to several tests, which, if applied to silver prints, would have proved destructive.

Among these tests are nitric, hydrochloric, sulphuric, sulphurous, and hydrosulphuric acids; the alkalies; bichloride of mercury; hyposulphite of soda; cyanide of potassium, sulphide of ammonium and others, none of which exert the slightest action on the print.

Those who are familiar with the details of the earlier method adopted by Mr. Willis, Jr., will not fail to see in what respects this indefatigable experimentalist has improved this valuable method of printing, which has a most important future before it in other directions than in the production of prints upon paper.—*The British Journal of Photography.*

ORIENTAL STYLE AS APPLIED TO FABRICS.

TAKING for granted the possible extension of Eastern requirements, we assume an increasing art tendency among the users of our textile fabrics at home. The proof of this latter hypothesis depends less upon any mere proportion that fancy goods may form in the aggregate production than upon the artistic quality of the styles bought. For that is, without doubt, a higher taste which dictates the use



No. 1.—EGYPTIAN.

of plain cloths, skillfully made up and arranged so as to show beautiful lines and pleasing contrasts, than the one which exhibits itself in a choice of the vulgar, *outré*-looking stripes and checks which have been our staple productions during the last ten years. A new art faith, less in accordance with domestic tradition, and more consistent with the extended views of a great empire, is being initiated. Besides becoming more cosmopolitan in his general views, the modern Englishman pays some attention to the traditions of other races and to the history of the world. The old accusation of insular narrowness of vision is a charge which can no longer be laid at his door. Political combinations of the widest character indicate the absorbing interest which Englishmen take in the future of the world's commerce, and a vast empire is being consolidated, the ramifications of whose commercial demands will be of the greatest extent. From such causes fresh notions of taste must necessarily arise, especially in the minds of our people at home.

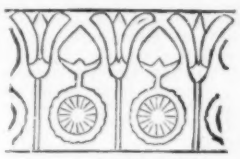
No. 2.—EGYPTIAN.

The interest attached at the present time to antiques and "curios" is beginning to find expression in public art museums. Picture shops and fancy repositories are springing up around us in rank profusion. All this must have its effect upon the public mind. And if what we now see is the outcome of our hitherto limited chances of popular education, what may we expect when every child in the realm has opportunities for a study of the beautiful? And in the formation of this new art taste, history, and particularly ancient history, cannot fail to take a prominent part. This brings us to the important question as to whether, in our neglect of these influences, we have acted wisely. The improving taste in textile fabrics can only be part of a general public tendency, which is shown in a manner far more marked and irrefutable in the furniture and pottery trades than in many others. The manufacturers of goods intended to clothe the "human form divine" seem to be last on the road to fame, at least such is the case in England. In furniture cloths we

No. 3.—EGYPTIAN.

find the cultivation of correct methods is considered a thing of the first importance. Instance the tapestries of Messrs. Barber & Miller, the Barrow Flax and Jute Company, and Messrs. J. & J. S. Templeton, in the Paris Exhibition, as examples of an appreciative study of Egyptian, Persian, and other modes, down to our own Queen Anne and Adam's styles. It may be argued that these are fabrics intended to supply the wants of high class customers, but even these goods are often made in low materials, the price being paid for style, and not for quality. We see no reason why good style should not enter into low fabrics. In the galleries of the Louvre and British Museum, some of the divinest forms ever shaped by the hand of man are to be found among the common red clay ware, fashioned by the Etruscan potters.

Numerous objects made from the most ordinary materials, and almost priceless from an art point of view, lie treasured in the cabinets of the refined and intellectual. Whence this fondness for objects whose only recommendation is their modest beauty? It arises partly from those educated notions which hitherto have been confined to the upper classes. And now that the advantages of education and the increased spread of art knowledge are combined, is it not fair to expect some similar result in the lower ranks of our large population? Art learning is an education in itself—one that to



No. 4.—EGYPTIAN.

some extent comes naturally with many minds, but which requires observation, comparison, and patient study before it can be perfected. The artist dwells in a world all his own. He peoples it with images oft of his own creating. "Beautiful and consoling thoughts" hover around him, adding interest and incentive to an elevated life. As these truths begin to be felt, we may experience a great demand for really artistic productions.

Having said so much in support of a study which must be of material assistance to those who wish to succeed in manufacturing, let us see how it can be best pursued. At the end of our last article we gave some four different examples of the simplest types of Eastern ornament. We chose these from the commonest specimens in order to illustrate our theory, which is, that each of the great empires, or races, had a style of its own. The Egyptians and Assyrians, though having many principles in common, differ very widely in their treatment of detail. We are led, therefore, to select a few of the most traditional ornaments of each empire, studying as we go along their chief features and original meaning. A careful analysis of these first principles, followed by a comparison in which we are enabled to see the different results placed side by side, is, we are convinced, the readiest way of gaining real information upon the subject. With this object in view, we wish to present the

No. 5.—ASSYRIAN.

reader with a view of the most representative models, or types, of each of the ancient monarchies, setting forth, at the same time, the principal characteristics noticeable in each, with a view toward inculcating an accurate perception of the peculiar merits of each style. These illustrations are not chosen as samples to be faithfully copied, but as models possessing in the largest degree the peculiar attributes of the peoples which they represent, and because they best set forth those principles upon which we may base a correct revival of ancient practice. As we become thoroughly acquainted with the laws which govern the imitation of the most ordinary symbols, and guide the artist in his practice, we shall be able to vary our modes of drawing so as to produce an almost infinite number of differently formed figures, all of which shall be faithful to the traditions of the people whose practice we intend them to represent.

One of the commonest faults of English textile designing, especially in the trail figures, etc., of the worsted district, is that much of it is meaningless. The effort made in drawing a figure is not an intellectual work. Much more mechanical

No. 6.—ASSYRIAN.

labor is spent upon the drawing than study upon the idea intended to be conveyed. Not a single line or curve should be introduced except as being part of the plan of conveying an impression which the mind can dwell upon with pleasure or profit.

The simplest ornaments, suggesting objects of well known beauty, afford at all times more gratification to the sense than the labored productions, where mere drudgery gets the better of accurate conception. In choosing our examples we have been influenced by those designs which illustrate the individuality rather than the mere beauty of each people's manner. The first four ornaments are Egyptian. They are correct symbols of plants culled from the groves, which adorned the banks of their beautiful river. The first idea which strikes the eye of the observer is the regularity and mathematical precision, noticeable in all their examples. Throughout Egyptian ornament we are ever reminded of

No. 7.—GREEK.

the presence of the compass and the square. Our thoughts are led to contemplate the arts of the people who built the pyramids, and the origin of mathematical science irresistibly dawns upon our imagination.

In Fig. 1, which represents a bunch of papyri, we are presented with an ornament conventionalized, not a carefully drawn likeness of the original; and this a point upon which ancient and modern practice is most at variance. The ancients believed (and those Eastern tribes least affected by civilization still believe) that an ornament need not be a faithful likeness or picture, but should embody a general notion of what it is intended to represent. In other words, they believed more in the symbolic and less in the imitative character of art than we do.

Fig. 2 is perhaps a still earlier representation of a palm tree; not a single line is here thrown away, and though it may seem somewhat rude to modern eyes, yet there is an evidence of notion about this simple figure—a notion which takes in the full scope of its task, and renders all the truth with the fewest strokes and in the humblest manner.

Fig. 3 is also a simple ornament (papyrus and flower, whose unostentatious yet suggestive style charms the eye by its very simplicity.

No. 8.—GREEK.

No. 4 is perhaps slightly inferior to the last named, but it possesses the quality of much variety in form, attained by very few lines. Having seen some of the chief characteristics of Egyptian art, as shown in the above examples, we will now pass on to the study of Assyrian and Persian models.

The same love of geometric figures which is a characteristic in Egyptian art is, in many cases, to be found here; but there is also a tendency toward fullness of detail and excessive curvature which seldom appeared in Egyptian styles. The Assyrian knop and flower patterns are perhaps as free from the charge of over decoration as any, and in these they follow closely the Egyptian models; but, taking a general view of Assyrian ornament, it is easy to recognize great innovations upon the practice of their forerunners in art.

The accompanying scroll, No. 5, gives a fair notion of the voluptuous and detailed manner noticeable in their designs, and prepares our eyes for the splendid curvature of the Greeks. The leading features of this immortal race, as shown in their art, consist in a delicate sensibility, or refinement of manner, in depicting an object, and in the facility and grace which they exhibit in curvature. All their figures possess a character of conscious beauty, more modest than imposing, and showing itself sometimes in an almost Puritanic sparsity of ornamentation, as in the beautifully simple figure at No. 6, and at other times losing itself in an intricacy of curves, as seen in No. 7, which is one of the best representations of the famous honeysuckle pattern. Fig. 8 attracts us by the freedom and grace of its flowing curves. There is a wild beauty about this bit of plant formation that whispers to us of far off "fields and groves, where birds attune the trembling leaves."

And so the measure of genius is its suggestiveness; however indifferently the detailed likeness is rendered, so long as it correctly embodies a single feature typifying the individualism of the object it seeks to represent, it has claims to be called a work of art.

There may be some manufacturers who have little faith in the usefulness of art education. To these our answer is—We refer you to the productions of your Continental neighbors. Are you prepared, with your present art knowledge, to do likewise? If not, are you forever to remain *hors concours*, timidly admiring the bolder spirits around, but yourselves fearful to enter the fray?

We have too much confidence in the intellectual vigor of our race to suppose such a thing. On the contrary, we witness daily proofs of revival in our art fabrics, and we think the time is not far distant when genius and education will add their elevating influence to the calling of the manufacturer, that so, surpassing all former efforts, he shall leave to posterity noble relics of an interesting past.—*Textile Manufacturer.*

VOLUMETRIC DETERMINATION OF ZINC.

ACCORDING to C. Mann, the zinc is first converted into chloride. Then, the solution being treated with a few drops of a concentrated solution of iron-ammonia alum, a solution of silver nitrate of known titre is added. By retitring by ammonium rhodanide till a weak red color shows, the excess of silver may be determined; hence the quantity of silver necessary to precipitate the chlorine, by which the quantity of zinc may be calculated. In order to convert the zinc into chloride, the substance to be examined is dissolved by nitric acid, acetate of ammonia is added, and then a current of sulphureted hydrogen is passed through the solution, upon which the precipitate is collected on a filter. The latter and its contents are placed into a beaker with about 50 c.c. of water and an excess of pure chloride of silver, and boiled till the liquid becomes quite clear. The remaining precipitate, formed by undecomposed chloride of silver and silver sulphide, is well washed out. The filtrate is collected and a few drops of ammonia added when the solution is ready for testing.

PROFESSOR FISCHER, of Prague, has been poisoned by a mixture of sal-ammoniac and cyanide of potassium while endeavoring to find a method of rendering the cyanide harmless.—*Chemiker Zeitung.*

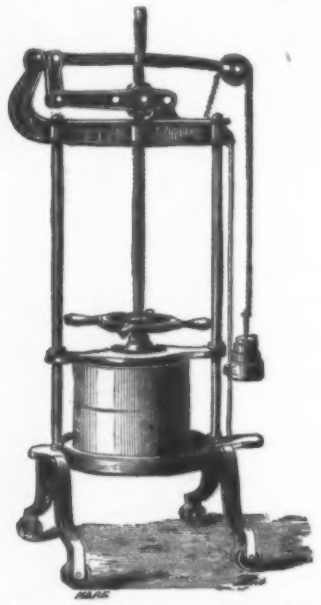
ENGLISH CHEESE PRESSES.

AMONG many kinds of cheese presses those on the lever principle seem to be the favorite, if the frequency of their presentation in the Exhibition is to be taken as a guide.

The point particularly insisted upon in a cheese press is that the pressure shall not slacken as the cheese is reduced by compression.

The portions most exposed to pressure are made of wrought iron, which gives them more strength and compactness, and saves weight in transportation.

The action of the press is very simple. The cheeses in their hoops being placed on the platform, the screw is turned to



COMPOUND LEVER CHEESE PRESS

the left by means of the spokes on the wheel, until, by the pressure on the cheeses, the follower is stopped. The continued turning of the wheel then elevates the lower of the two levers, and thus raises the second lever, on whose long arm the weights are suspended. Either or all of the four weights can be used, according to the pressure required, and the pressure is continuous until the lower lever strikes the top of the frame, when it can be raised again by a few turns of the wheel.

In the double chamber lever press the same system of compound levers is used, but the screw is turned by crank and bevel gearing, and the pressure is upon the cheese on the

DOUBLE CHAMBER LEVER CHEESE PRESS.

upper table, and through that to the lower one. When the cheeses in their hoops are placed on the shelves the screw is turned until the upper shelf rests upon the top of the lower cheese hoop, and then the side rods of the follower commence to slip through guide holes in the sides of the upper shelf until the follower rests upon the upper cheese hoop, and meets with sufficient resistance to allow a farther turning of the screw to lift the levers and the weight.

EDWARD H. KNIGHT.

TO FIND FREE TARTARIC ACID IN WINE.

THE wine is evaporated to a sirupy consistence and well shaken with ether. The ether is then decanted and evaporated to dryness, when a crystalline residue will be left in case the wine contained tartaric acid in its free state. If this be dissolved in water and an alcoholic solution of acetate of potassium added, a precipitate of bitartrate of potassium will be formed. Most of the test books on chemistry claim that tartaric acid is insoluble in ether; this is not so.—PROF. CLAUS, *in Polytechn. Notizbl.*

BORAX soap is recommended for freeing articles of glass from the last traces of grease.

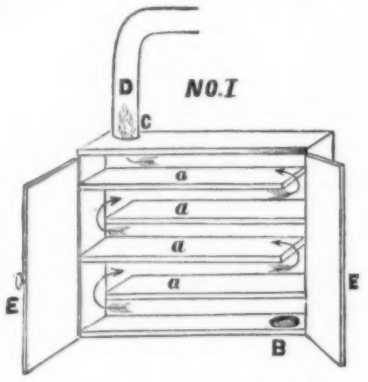
HOW TO MAKE EXCELLENT PHOTO TRANSPARENCIES.

By PROF. E. STEBBING.

FOR the advantage of the readers of the Philadelphia *Photographer*, who would like to make transparencies for the stereoscope or the lantern, I will give the formula for the preparation of albumen plates, which, although not so rapid as collodion ones, will give a proof so superior to the other that, as soon as the difficulty of manipulation is vanquished, the operator will be so enchanted that he will discard all other processes for this one. I will now treat the subject fully, and in the following order:

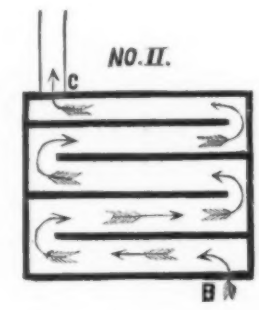
1st. The dark room.
2d. Preparation of albumen.
3d. Cleaning and polishing the plate.
4th. Coating the plates with albumen and drying.
5th. Sensitizing.
6th. Exposing and developing.
7th. Toning.

The first subject requires the most care. The dark room



must be very small, the ceiling and the walls painted in oil, the floor laid with marble or slate slabs, a large sheet of plate glass fixed to serve as a table, a kind of cupboard with leveled glass shelves, and as few chemicals as possible. This is what the dark room must contain in order to prepare albumenized plates with any degree of certainty. Dust is the greatest enemy of this admirable process, and it is the first to be vanquished; that is why I advise a small room. The walls, ceiling, and floor are so arranged that they can be washed now and then to take off the dust. The drying cupboard is made of varnished zinc, as in Diagram I.

a, plate-glass shelves the same width as the cupboard, but an inch and a half shorter; the first shelf touches the zinc on the right-hand side; the second shelf touches the zinc cupboard on the left-hand side, and so on, alternately, to the top of the cupboard. On the right-hand side of the bottom of the cupboard is a hole, B, over which is soldered a piece of fine wire gauze, covered with a piece of fine linen. This hole is an inlet for air, and the fine linen acts as a filter to stop dust and dirt from entering with the air. It would be well even to dip the linen into a little glycerine, and change it now and then. On the left-hand side of the top is another hole, which forms outlet, C; this is covered by a piece of sheet-iron piping, in the interior of which is placed a Bunsen burner, D. The prepared plates having been laid upon the glass shelves, the doors, E E, are closed. The Bunsen burner lighted, a draught is established in the chim-



ney, and fresh air is drawn through hole, B, which, following the arrows, Diagram II., passes over the surface of all the plates and dries them very quickly; if the air be very damp it can be made to pass through chloride of calcium. In fact, it can now be seen that to succeed with this process great cleanliness is required, and, above all, great care not to open doors too rapidly, or to go in and out of the dark room too frequently, so as to raise the dust. I dwell very long upon this subject, being certain that this is one of the greatest stumbling blocks in the process.

2d. Preparation of the Albumen.—Take 17 new-laid eggs (eggs a week old are the best), break them and carefully separate the yolks from the whites; take out the germs (treadles.)

Weigh out 5 grammes of iodide of potassium, $\frac{1}{4}$ gramme iodine, mix therewith 500 c.c. albumen, then pour into a large basin and whisk into a froth; this is allowed to remain twenty-four hours in a cool place and to settle down; the product is then filtered through a piece of clean linen, and is then ready for use.

3d. Cleaning of the Glass.—It can be easily understood that the first condition to obtain a pure and perfect image is to cleanse the surface of the glass from all impurities. This is done by plunging, first of all, the glass in a strong solution of potash; it is then well washed and left for a few minutes in a tray containing water slightly acidulated with nitric acid; it is then well rinsed and wiped dry with linen towels. Take fine whiting, and with water make a thick paste, and wipe or spread it all over the glass and allow it to dry, then rub it all off with a piece of fine linen. A few grains of talc (I mean as much as would lie upon a pin's head) are now put upon the glass, and rubbed over it in every direction with a piece of wash-leather. A badger brush is now drawn over the surface, and the glass is ready for coating.

4th. Coating the plate is considered by all as the most difficult operation. This must be done in a room set apart for the express purpose, and free from dust. The best manner of operating is to take up, by a tube, the exact quantity of albumen required for each plate; breathe upon the glass and let the albumen run out of the tube; take a clean glass rod and equalize it all over the surface, and then put it into the cupboard upon the leveled glass shelves to dry in the manner as previously described. The plates thus prepared can be kept for years.

5th. Sensitizing is done in the same manner as with the collodion process. The bath is prepared as follows:

Distilled water	100	ounces.
Nitrate of silver	10	"
Glacial acetic acid	10	"

After the plate has remained about a minute it is taken out of the bath and plunged into a tray containing distilled water; it is then thoroughly washed in ordinary water and then left to dry. After a time the silver bath becomes tinted through the organic matter dissolved out of the plates. This color can be taken away by the addition to the bath of some chloride of silver or silicate of alumina (kaolin). This coloration does not exercise any bad effect, according to the opinion of several manipulators.

6th. Exposure and Developing.—If the plates are intended for stereoscopic transparencies, lantern slides, etc., the negative is put into a printing frame and the prepared glass upon it. It is then exposed to a diffused light for a few seconds, and then taken into the dark room to be developed; naturally the camera can be employed for the same purpose. The development of these plates is long and tedious. A solution of gallic acid is made warm, and the plate plunged into it:

Distilled water	500	c.c.
Gallic acid	8	grammes.
Acetate of lime	4	"

The plate is left in this solution until the liquid becomes cold, a few drops of a solution of silver nitrate are added, and the image makes its appearance. More nitrate will intensify rapidly.

7th. Toning glass transparencies is necessary to give them the pleasant appearance they bear.

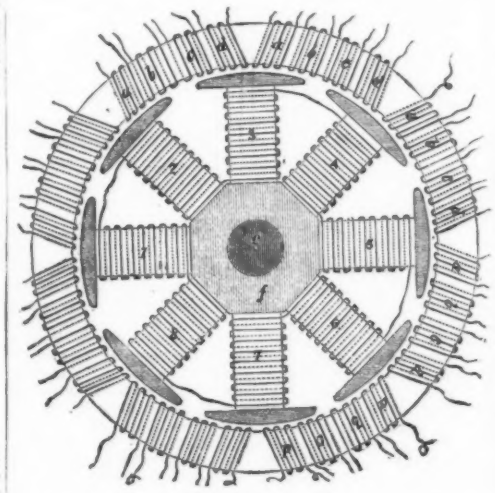
To have a beautiful purple color they are toned in a chloride of gold bath.

To procure a very agreeable sepia color, they are plunged into a weak solution of bichloride of mercury, and then, after washing, into a chloride of gold bath.

Fix in hypo, either before or after the toning.

THE GRAMME DYNAMO-ELECTRIC MACHINE FOR PRODUCING ALTERNATING CURRENTS.*

THE recent improvement in the Jablochkoff system of electric illumination, and that which has given to it its present success, is the employment of an alternating current of electricity for establishing the electric arc between the carbon points. If the Jablochkoff candle is used with a continuous current, the positive carbon is consumed at twice the speed of the negative, but with a rapidly alternating current instead of a continuous one, the carbon will consume at an equal rate, each being alternately positive and negative to the other, and an alternating current possesses this further advantage, namely, that each stick of carbon is kept beautifully pointed instead of rough and irregular, and this sym-



metrical consumption of the carbonaceous matter is a great source of steadiness in the light.

The Jablochkoff candle may be used with advantage with any dynamo-electric machine which produces an alternating current, or by a continuous current machine fitted with a commutator, by which the direction of its current is reversed every few seconds, but this arrangement for obtaining from a continuous current machine a series of currents in alternate directions, can only be accompanied by great loss of electricity, and, therefore, of motive power; and it has been found much more economical and advantageous to use machines whose currents are originally generated in alternate directions. Of these, the machines of Holmes, of the Société l'Alliance, and of some others, would answer the purpose, but M. Gramme has designed a machine which is, to some extent, a modification of his previous arrangement, which not only produces an alternating current of electricity, but is capable of dividing that current, so as to supply electricity to four, six, sixteen, or more electric lamps, or candles. It is this new machine of M. Gramme which is now employed for producing the electric currents by which some 300 electric lamps are nightly illuminating the Boulevards and public buildings of Paris.

This machine, the essential features of which are shown in the figure, consists of a ring of soft iron similar to that used in the earlier continuous-current machines of the same inventor. This ring is, like its predecessors, bound with coils of insulated copper wire, but, unlike those of the earlier machines, the direction of winding is alternately

* Condensed from *Engineering*. The figure from sketch sent by Prof. E. Thomson.

right and left handed, the wire being wound in one direction, so as to cover one-eighth part of the circumference of the ring, then changing its direction, being wound in the contrary way over the next eighth part, and so on round the ring, each of the eight sections of the ring being wound in the reverse direction to that in which its two contiguous sections are wound. Thus, while the earlier Gramme ring might be described as an electro-magnet bent round in a circle and joined to itself, the ring of the new machine may be looked upon as eight curved electro-magnets placed end to end with their similar poles in contact, so as to form a circle. This ring is rigidly fixed in a vertical position to the solid framing of the apparatus, the inducting electro-magnets revolving within it. Here again it differs from the continuous-current machine in which the magnets were fixed, and the ring was rapidly rotated in the magnets fixed between their poles. The electro-magnets, of which there are eight, are fixed radially to a central boss, *f*, revolving upon a horizontal steel shaft, *e*, running in suitable bearings attached to the framing, and an external pulley enables the machine to be driven by a band from a steam-engine or other motor. The radial electro-magnets are alternately right and left handed in the direction in which their coils are wound, so that if they be numbered 1, 2, 3, 4, etc., up to 8, respectively, those represented by even numbers will have one polarity when a current is sent through them all together, while those whose numbers are uneven, will have an opposite polarity. The poles farthest from the central boss, in all the magnets, are spread out so as to increase the area of the magnetic field by which electric currents are induced in the coils of the ring.

In the old machine of M. Gramme, the electro-magnets were excited by the current from a special Gramme ring mounted on the same shaft as the two rings which produced the available current, and the current from the first ring was exclusively devoted to exciting the electro-magnets. In further improvements upon his continuous current machine, M. Gramme dispensed with an extra and special ring for charging the magnets, and devoted a portion of the current from a single ring to that purpose, two coils being wound on the same ring. In the present machine, however, there is no self-contained apparatus for producing the current by which the electro-magnets are charged, although there is nothing to prevent an ordinary Gramme machine being attached to the same shaft. It is found more convenient, however, to use the new machine simply as an apparatus for dividing the current, and for giving to it a reciprocating nature, and, therefore, an altogether separate electro-motor is employed. An ordinary voltaic battery of sufficient power would answer the purpose, but in practice a small and separate Gramme machine of the continuous-current type is employed, driven by a separate strap, and the current from this machine being caused to traverse the coils of the rotating radial electro-magnets, they are magnetized to saturation with but a small expenditure of motive power.

Each of the eight sections of the induction-ring are made up of four sub-sections, *a*, *b*, *c*, *d*, *a*, *b*, *c*, *d*, etc., all of which, in any one section, are wound in the same direction. By coupling the coils of these sub-sections in various ways, a division of the current may be made into 32, 16, 8, or only 4 circuits, and this is one of the most valuable qualities of the system.

From a consideration of the above description, it will be seen that all the sub-sections or coils marked *a* are influenced by the rotating magnets in precisely the same manner, for the influence of a north pole upon a coil wound in a positive direction, is precisely the same as that of a south pole upon a coil wound in a negative direction, and similarly the currents induced in all the coils marked *b* are similar in direction to one another, no matter what may be the position of the rotating magnets. And in order to obtain four currents from the machine by which four lamps may be illuminated, all that is necessary is to connect together in series all the coils marked *a* for one circuit, all the coils marked *b* for a second circuit, all the coils marked *c* for a third circuit, and all the coils marked *d* for a fourth circuit. As the induction rings are fixed, there is no difficulty in "tapping" the currents from the machine, and the apparatus is fitted with terminal screws on the exterior of the rings by which that can be effected, and by which variations in the method of coupling up may be made.

The current for the small machine is led to the rotating magnets through flat brushes composed of silvered copper wire fixed to the framework of the machine, and rubbing against two insulated drums or cylinders of copper, the first being connected to one end of the magnet-circuit and the second to the other.

When the shaft carrying the magnet is rotated, the expanded magnetic poles pass close to the coils of the induction-ring, and in so doing induce within them currents of electricity, the strength of which depends upon the intensity of the magnetic field brought over them, and increases with the speed of rotation.

The new Gramme machine, as at present constructed, is made in three sizes. The largest is capable of supplying the current to 16 Jablochkoff candles, at a speed of 600 revolutions per minute, and absorbing a motive power of about 16 horse power, costs, with the smaller machines for charging the magnets, 10,000 francs (= £400), its length, including the shaft and pulley, is 35 ins., its width 30 ins., and its height about the same; the total weight is a little over 12½ cwts. The second size machine requires 6 horse power to drive it, at a speed of 700 revolutions per minute, and supplies the light to 6 Jablochkoff candles, and costs, with its small machine, 5,000 francs (£200). It measures 27 ins. in length, 15 ins. in width, and 20 ins. in height, and weighs rather over 5 cwts. The smallest size actuates, at a speed of 800 revolutions per minute, 4 Jablochkoff lights, and absorbs 4 horse power of motive power. Its dimensions are as follows: Length, 21 ins.; width, 15 ins.; height, 18 ins.; and its total weight is about 3½ cwts. In addition to these three sizes, M. Gramme has a new machine in hand, which differs in construction, in several material points, from those to which we have referred, and from which he hopes to effect a saving in both the prime cost and the cost of working the machine. It is designed for use with 2 Jablochkoff candles.

It will be seen from the above figures that the power absorbed is almost exactly one horse power for each candle, and the result of a year's working of the system at the Hotel and Magasins du Louvre very closely supports that estimate.

That M. Jablochkoff has solved the problem of producing a steady electric light, requiring but little attention, and suitable for street illumination of a very beautiful order, must be self-evident to all visitors to Paris at the present time.

Whether the system, however, is a success in an economical and commercial point of view, is another question altogether, and remains to be proved. We are rather inclined to the opinion that in its present stage it is rather costly, although light for light it will compare favorably with gas.

The whole system, much as it adds to the beauty and attractions of the city of Paris, must still be looked upon as in its childhood; it is rather more than a step, it is a long stride in the right direction, and we cannot but believe that further improvements, both in the construction of the machines for generating the electrical currents and in the apparatus for converting those currents into centers of illumination, will burst through all obstructions placed in its path. —*Journal Franklin Institute.*

A NEW SYSTEM OF ELECTRIC LIGHTING AND A NEW FORM OF ELECTRIC LAMP.

By Profs. ELIHU THOMSON and EDWIN J. HOUSTON, of the Philadelphia Central High School.

HAVING been engaged in an extended series of experimental researches on dynamo-electric machines, and their application to electric lighting, our attention has been directed to the production of a system that will permit the use of a feebler current for producing an electric light than that ordinarily required, or, in other words, the use, when required, of a current of insufficient intensity to produce a continuous arc. At the same time, our system permits the use of a powerful current, in such a manner as to operate a considerable number of electric lamps placed in the same circuit.

As is well known, when an electrical current, which flows through a conductor of considerable length, is suddenly broken, a bright flash, called the extra spark, appears at the point of separation. The extra spark will appear, although the current is not sufficient to sustain an arc of any appreciable length at the point of separation.

In our system, one or both of the electrodes, which may be the ordinary carbon electrodes, are caused to vibrate to and from each other. The electrodes are placed at such a distance apart that in their motion towards each other they touch, and afterwards recede a distance apart which can be regulated. These motions or vibrations are made to follow one another at such a rate that the effect of the light produced is continuous; for, as is well known, when flashes of light follow one another at a rate greater than twenty-five to thirty per second, the effect produced is that of a continuous light. The vibratory motions may be communicated to the electrodes by any suitable device, such, for example, as mechanism operated by a coiled spring, a weight, compressed air, etc., but it is evident that the current itself furnishes the most direct method of obtaining such motion, as by the use of an automatic vibrator or an electric engine.

In practice, instead of vibrating both electrodes, we have found it necessary to give motion to but one, and since the negative electrode may be made of such size as to waste very slowly, motion is imparted to it in preference to the positive. The carbon electrodes may be replaced by those of various substances of sufficient conducting power.

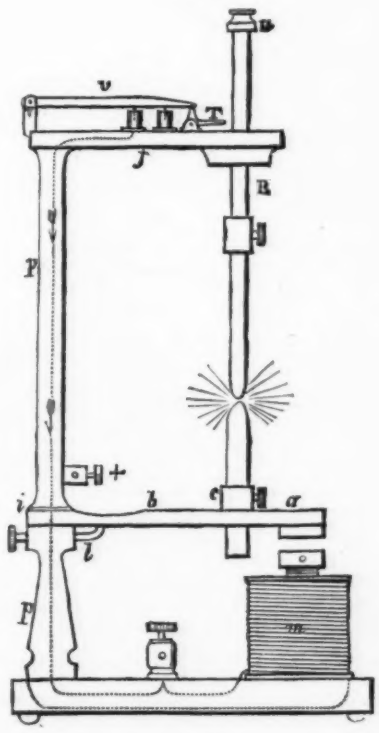
In this system, when desired, an independent battery circuit is employed to control the extinction and lighting of each lamp.

A NEW ELECTRIC LAMP.

The following is a description of one of the forms of electric lamp which we have devised, to be used in connection with our system of electric lighting:

A flexible bar, *b*, of metal is firmly attached at one of its ends to a pillar, *p*, and bears at its other end an iron armature, *a*, placed opposite the adjustable pole-piece of the electro-magnet, *m*. A metal collar, *c*, supports the negative electrode, the positive electrode being supported by an arm *j*, attached to the pillar, *p*. The pillar, *p*, is divided by insulation at *i*, into two sections, the upper one of which conveys the current from the binding-post marked +, to the arm, *j*, and the rod, *r*, supporting the positive electrode.

FIG. 1.



The magnet, *m*, is placed as shown by the dotted lines, in the circuit which produces the light. The pillar, *p*, is hollow, and has an insulated conducting wire inclosed, which connects the circuit-closer, *v*, to the binding-post marked —. The current is conveyed to the negative electrode, through *b* and the coils of the magnet, *m*. When the electrodes are in contact, the current circulating through *m* renders it magnetic and attracts the armature, *a*, thus separating the electrodes, when, on the weakening of the current, the elasticity of the rod, *b*, again restores the contact. During the movement of the negative electrode, since it is caused to occur many times per second, the positive electrode, though partially free to fall, cannot follow the rapid motions of the negative electrode; and, therefore, does not rest in permanent contact with it. The slow fall of the positive electrode may be insured either by properly proportioning its weight or by partly counterpoising it. The positive electrode thus becomes self-feeding.

The rapidity of movement of the negative carbon may be controlled by means of the rigid bar, *l*, which acts, practically, to shorten or lengthen the part vibrating.

In order to obtain an excellent but free contact of the arm, *j*, with the positive electrode, the rod, *r*, made of iron or other suitable metal, passes through a cavity, *s*. Fig. 2, filled with mercury, placed in electrical contact with the arm, *j*.

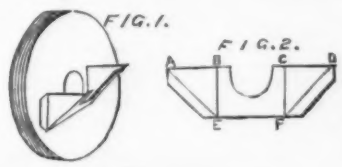
Fig. 2.

Since the mercury does not wet the metal rod, *r*, or the sides of the opening through which it passes, free movement of the rod is allowed without any escape of the mercury. We believe that this feature could be introduced advantageously into other forms of electric lamps.

In order to prevent a break from occurring in the circuit, when the electrodes are consumed, a button, *v*, is attached to the upper extremity of the rod, *R*, at such a distance that when the carbons are consumed as much as is deemed desirable, it comes into contact with a tripping lever, *l*, which then allows two conducting plugs, attached to the bar, *v*, to fall into their respective mercury cups, attached, respectively, to the positive and negative binding-posts by a direct wire. This action practically cuts the lamp out of the circuit.—*Franklin Journal.*

HOW TO MAKE A CAMERA LUCIDA IN TEN MINUTES.

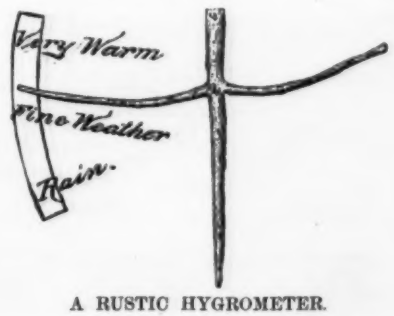
I FIRST procured a pill-box lid which just fitted on to the eyepiece of my microscope, and in the center of it made a circular aperture about the size of the top lens of the eyepiece. I then cut a piece of card to the shape of Fig. 2, in which



the angles, A E B and C F D, are both 45°, just nicked with a penknife along the lines A E, B E C F, and D F, and with a little gum affixed to the lid, as in Fig. 1. A piece of thin covering glass attached to B E C F, and therefore inclined at an angle of 45°, completed the apparatus, which answered remarkably well. C. G.

A RUSTIC HYGROMETER.

A CORRESPONDENT of *La Nature* describes a simple and effective hygrometer which he found in use by an old peasant. It consisted simply of a thin, cross-shaped fir twig, fastened by two nails. At the end of one of the side sprigs there was a sort of index, upon which was inscribed



A RUSTIC HYGROMETER.

"Very warm," "Fine weather," "Rain." The twig (upon which the bark was allowed to remain) was about 3 to 4 millimeters in diameter, and hung free up to its center, where it was attached by a nail.

NEW TELEPHONIC TRANSMITTER.

By P. DUMONT.

THIS system, which has given the author results superior to those of any other apparatus of a similar kind which he has been able to try, is a combination of the pack-thread telephone and of the electric charcoal microphone. A parchment membrane of 12 centimeters in diameter is stretched over a vertical frame. In its center is fixed a thread secured by a knot on one side, and which taking, on the other side, at first a horizontal direction, passes round a small pulley and supports at its other extremity a small cone of brass suspended by a hook fixed to the center of its base. This piece, which is, relatively speaking, tolerably heavy, plunges

its point to the depth of about 1 millimeter into a metallic cube full of powdered gas coke, and fixed upon the horizontal plate, which, forming the foot of the apparatus, supports the stem of the frame fitted with the diaphragm. One of the poles of the battery (a Leclanché of four elements) is connected with the metallic cone, and the other with the cube containing the coke dust. The slightest vibrations imparted to the membrane by sound waves suffice to modify the pressure of the cone in the coke dust, thus determining variations in the intensity of the current.

THE RINGS OF SATURN.

The most wonderful body belonging to our planetary system is undoubtedly Saturn with its rings and satellites. During the last two years Saturn has passed through a period of its journey around the sun, during which it presented itself to us in its most interesting positions. The rings were repeatedly nearly hidden from view, and, as this takes place only every fifteen years, the planet was watched with attention by astronomers at all suitable points.

The following, containing a partial description of the different phases as observed at Paris by Camille Flammarion, we take from *L'Illustration* (No. 1860, October, 1878):

The rings of Saturn have now for some time been exposed to our view, and, by means of a telescope of moderate power, we can now gradually see them disappear again.

When we examine this planet for the first time through an astronomical telescope, we are struck with astonishment and can hardly believe our eyes. Of all the observations I made when beginning to study astronomy, three will never pass from my memory; they are those of the rings of Saturn, of the moon, and of the triple star (orange, green, and blue) of Andromeda.

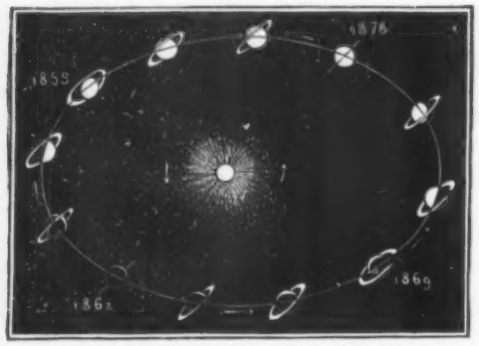


Fig. 1.—CHANGES IN THE ASPECT OF THE RINGS OF SATURN AS SEEN FROM THE EARTH.

Truly Saturn presents a unique appearance. The globe or planet proper is at a certain distance surrounded by a flat round ring. As from our position we only obtain an oblique view of the same, it does not show itself in its true circular form, but as an eclipse, the small diameter of which is of variable length.

As seen from the earth, one part of the ring seems to pass through the planet, while the opposite side seems to pass behind it. Near to where the ring projects itself on the planet its shadow may be observed in form of a dark zone. The planet is itself not a source of light, but receives it, like all others, from the sun.

The ring does not seem to consist of one single piece, but is divided into two concentric parts, the separating line being apparently situated nearer to the outer than the inner edge; it is probable, that there are a greater number of rings, as very powerful instruments have shown indications of further subdivisions. One part of the ring is also more luminous than the other, while the latter is a little more transparent.

This is the only instance known of a celestial body with partially plane surface, and this is not less than 71,000 miles (French) in diameter and 11,800 Fr. miles in width, but is only from 60 to 78 kilometers thick. Both sides are flat and alternately exposed to view, just according to the different positions in which Saturn and earth are placed to each other in course of their journeys. Probably these rings consist of an enormous number of distinct particles, travelling around the planet at different rates of velocity, according to their respective distances from the same.

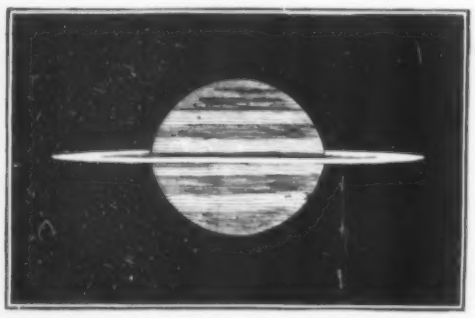


Fig. 2.—ACTUAL VIEW OF SATURN DURING THE OBSERVATIONS OF M. FLAMMARION IN SEPTEMBER, 1878.

According to my calculations, the particles forming the more transparent part of the ring must revolve around the planet in from five hours and fifty minutes to seven hours and eleven minutes, according to their distance from the common center of gravity, the zone, being nearest, traveling fastest; the particles forming the luminous part of the ring must revolve in from seven hours and eleven minutes to eleven hours and nine minutes. A point on the extreme outer edge would consume twelve hours and five minutes in accomplishing one revolution around the central globe. The interior edge moves at a velocity of 425 French miles per minute, or 25,500 miles per hour. The eight satellites accompanying Saturn at a greater distance may, however, produce deviations from the results as thus calculated. To their influence perturbations may be ascribed, causing the present unstable equilibrium, to which the preservation of the rings in their present form is probably due. It seems as if shocks, collisions, and other causes would continually endanger the existence of this strange structure, if it relied not to some extent on an exterior support. Let me here remark, that one of the most curious properties of Saturn is his lightness. Imagine a globe 864 times as large as the earth, but weighing only 92 times as much! The density of its constituents is seven times lower than the material composing our globe. Saturn would float on an ocean like a huge cork, and its inhabitants must be ethereal beings, swimming about in its atmosphere.

From time to time the ring disappears from our view in consequence of the compound movement of earth and Saturn, as may be easily explained. Supposing our position to be on a straight line, forming a continuation of the axis of rotation of Saturn, or, which is the same, as being directly overhead of one of its poles, we would see the ring in its true circular form. Supposing, on the contrary, ourselves placed in a plane laid through the equator of Saturn, we would see the ring only as a line crossing Saturn and protruding over its disk on both sides. Between these two extreme positions the ring presents itself in a more or less oval form, just according as we view it more or less obliquely. We never, however, come near enough to the direction of the axis of Saturn to see the ring show a short diameter of over half of the longer one.

Fig. 1 shows the rings as seen by the terrestrial observer according to the different positions of our globe. It will be seen that, at two points diametrically opposed to each other, only the edge of the ring is visible, and owing to the thinness of the ring, noticeable only by the most powerful instruments, as a fine, white, straight line.

This was the case, for the first time since 1862, in June, 1877, when the rings disappeared nearly altogether on account of the peculiar constellation of both planets, and again shortly afterward on account of being partially eclipsed. The following table shows the variation of length of the small diameter of the ovals formed by the ring since January, 1877:

			Seconds.
January	10,	1877	4·74
February	19,	"	3·22
March	11,	"	2·63
April	20,	"	1·41
May	10,	"	0·94
June	19,	"	0·45
July	9,	"	0·50
August	1,	"	0·89
September	7,	"	1·73
October	17,	"	2·58
November	6,	"	2·81
December	16,	"	2·34
January	5,	1878	1·83
February	14,	"	0·54
March	6,	"	0·17
"	26,	"	0·88
April	14,	"	1·57
May	5,	"	2·20
June	14,	"	3·19
July	5,	"	3·52
August	18,	"	3·35
September	2,	"	2·96
"	22,	"	2·44
October	12,	"	1·87

These numbers show how the length of the small diameter of the perspective view of the rings balances between certain limits. In June, 1877, the ring disappeared; subsequently the earth rose to some distance above the equatorial plane of Saturn, so that one side of the rings became visible again, reaching their maximum diameter in November. In March, 1878, we last saw the northern face of the ring, which had been visible since 1862, and the rings disappeared for a second time. At present, the 12th of October, we see the southern face to a limited extent yet; on the 24th of July, the earth was elevated 4·52″ above the southern surface of the rings; since then it has steadily approached again the equatorial plane of Saturn, being to-day at an elevation of 2·29″ above the same. This elevation will continue to decrease till the rings disappear for a third time. After that we will see their small diameter increase again, passing from the position indicated on the right, of 1878 (Fig. 1), to that on the left, exposing their southern surface to our view till 1885. In that year the small diameter will again be at its maximum, as in 1855, the position of the rings to us being symmetrical to that of 1869. Fig. 2 presents the actual appearance of Saturn during the month of September last.

The ambition of Saturn was not contented with the annular system we just admired. As stated above, it is supplied with a body guard of satellites, which, as far as our knowledge goes, has not its equal within the solar system. Eight moons accompany Saturn on its journey through the universe, representing an empire of millions of miles in area.

Hesiod thought he expressed sufficiently the dimensions of the universe when he said that the anvil of Vulcan was under way nine days and nine minutes to fall from heaven to earth, and just as long to fall from earth to hell. The distance indicated by this fall, although greater than the lunar orbit, would not equal that of the Saturnian system. The precise measures of astronomy are incomparably more poetical than the fictions of poets of the boldest imagination. The system of Saturn, so distant from us that the head of a pin held at arm's length is sufficiently large to hide it from our view, is not unlike a solar system on a small scale; we must say comparatively on a small scale, as the minute disk of the smallest satellite, as seen by us with the most powerful telescope, represents an area of millions of miles. There is nothing absolutely large or absolutely small in creation, and, worthy of our attention as this system is, it constitutes for its inhabitants really a universe for itself.

What are, finally, the conditions under which this republic of celestial bodies could be inhabitable? What similarities and what differences does it present compared with the earth? In what form could organic life exist on that star and its accessories?

The inhabitants of such a body must certainly differ widely from terrestrial beings. The light specific gravity of Saturn and the density of the atmosphere would necessarily imply a development of vital organization in unimaginable forms. To suppose, as it is probable, that there be nothing solid, that the planet itself were not a solid but a liquid body, that the living beings were of a soft, gelatinous material, would extend beyond the limits of scientific reasoning.

Nevertheless, there are more reasons speaking in favor of such a theory regarding Saturn than in reference to any other body belonging to our solar system. Its conditions of gravity are not only peculiar in general, but they vary even between one and the other latitude.

If we could penetrate into all of Nature's mysteries, we might perhaps find that the Saturnians have transparent bodies, through which the circulation of life might be observed; that they never feel the weight of matter; that they fly without wings in midst of a nutritious atmosphere; that they do not, like us, depend on a coarse, crude alimentation and its ridiculous consequences; that they are gifted with a nervous system incomparably more sensitive than ours, by which, so to speak, science is infused into them, while they study in a state of perpetual happiness the mysteries of creation, and live in an angelic state a life thirty times longer than ours.

No matter to what extent and by what forms of life Saturn may be inhabited, we need not doubt that nature has succeeded in utilizing all given conditions in a similar manner to, as it has done it with, our moderate terrestrial facilities.

[The Australian Medical Journal.]

PEROXIDE OF HYDROGEN IN THE BLOOD.

AN ATTEMPT TO EXPLAIN THE CURATIVE ACTION OF CERTAIN REMEDIES IN GENERAL USE.

By John Day, M.D.*

Although medicine has not yet attained the rank of an exact science, we are, fortunately, often enabled to call to our aid chemistry and other exact sciences for the purpose of demonstrating the correctness of our views regarding the nature and treatment of disease; and I shall endeavor this evening, by a few simple and easily repeated experiments, to show you that an approach, at least, toward a scientific explanation, may be offered for the use of a rather large number of our most favorite remedies. I have selected for this purpose the following well-known therapeutical agents, viz.: Cod-liver oil and other fixed oils and fats, oils of turpentine and other essential oils, common resin, the resin of guaiacum, myrrh, and ether. We have now before us a fair array of medicines in general use, and it will be my aim to show you that, although most of them differ widely in their general characteristics, they all possess one property in common, viz., the power of absorbing atmospheric oxygen and converting it into peroxide of hydrogen—a substance possessed of many curious and interesting properties, some of which are at present but little understood. It is composed of two atoms of hydrogen and two atoms of oxygen, hence its symbol is H_2O_2, and its combining weight 34. This compound is remarkable for the ease with which it parts with its second atom of oxygen, which is held in very loose combination; and also for the readiness with which, under certain conditions, it is resolvable into water and oxygen. Now, this decomposition may be effected in a variety of ways, but the rapidity with which it occurs when peroxide of hydrogen is brought into contact with the coloring matter of blood, with fibrin, or with pus, is a property which renders this substance highly interesting in a physiological point of view.

It is now generally believed that oxygen, as it exists in the blood, is in a more active state than ordinary atmospheric oxygen. Carpenter says: "As regards the oxygen contained in the blood, there is every reason to believe that it is chemically combined with the hæmoglobin of the red corpuscles in which it exists in the active or ozonized condition." Schönbein was the first to clearly show that oxygen is capable of existing in two different states of activity, each state having its own special affinities; and he supposed that ordinary oxygen was a perfectly neutral gas, and incapable of producing any oxidations until it had been chemically polarized and split up into ozone and antozone. He considered that the oxygen absorbed during respiration was thus acted on by the coloring matter of the blood; and the views I am about to submit for your consideration are to some extent a modification of those entertained by him. Instead, however, of believing, as Schönbein did, that the first change which occurs in the inspired oxygen is produced by the coloring matter of the blood, I hold that the first change is produced by the fat, which exists in the blood in considerable quantities, more particularly in the corpuscles; and I assume that this fat, which is in a state of extensively fine subdivision, is incessantly engaged in acting on the inspired oxygen contained in the red corpuscles, and converting it into peroxide of hydrogen—a substance which is instantly transformed by the coloring matter of the blood into water and oxygen—a gas which at the moment of its liberation is possessed of many of the characteristics of ozone, and is known to chemists as nascent oxygen; and I am inclined to believe that it is oxygen in this state, although perhaps not always liberated from peroxide of hydrogen, which gives rise to all the different oxidations that occur within the animal body during life.

INTERESTING CHEMICAL EXPERIMENTS.

I will endeavor to demonstrate the correctness of this theory by a chemical experiment. Oxygen in a nascent state, like ozone, is capable of oxidizing and turning blue the resin of guaiacum, but neither the oxygen contained in peroxide of hydrogen nor atmospheric oxygen is capable of effecting this change. Now, here is some human fat, which, like all animal fats that have been deprived of blood and freely exposed to the air, contains spontaneously generated peroxide of hydrogen. I will first place a little of it on a piece of white blotting paper, and then pour over it some alcoholic solution of guaiacum—a process which will not, you will find, be followed by any change of color in the guaiacum, the oxygen of peroxide of hydrogen being incapable of oxidizing and turning it blue; but, on the addition of a small quantity of the coloring matter of blood, you will perceive that a bright blue reaction will quickly ensue, thus showing that oxidation of the guaiacum has occurred.

FATS, OILS, AND OTHER SUBSTANCES THAT PRODUCE PEROXIDE OF HYDROGEN.

This result has been brought about by the coloring matter of the blood having transformed the peroxide of hydrogen contained in the fat into water and nascent oxygen. To make this illustration complete, I must now show you that the coloring matter of blood alone is incapable of oxidizing and turning blue the resin of guaiacum.

In stating to you just now that all animal fats which have been deprived of blood and exposed to the air contain peroxide of hydrogen, I did not intend to imply that fats containing blood were incapable of generating peroxide of hydrogen, but simply that, so long as any of the coloring matter of blood remained within them, the peroxide of hydrogen would be decomposed as rapidly as it was generated.

* A paper read before the Medical Society of Victoria, December 5th, 1877.

I cannot, of course, show you that fat, as it exists in the living body, is capable of converting the inspired oxygen into peroxide of hydrogen; nor can I show you that, during life, the fibrin and the coloring matter of the blood are capable of decomposing peroxide of hydrogen and resolving it into water and oxygen; but I can clearly show you that animal fats, out of the body, possess the property of generating peroxide of hydrogen, and of concentrating and storing it up, until they are brought into contact with blood, pus, or other substances which are capable of reducing it and liberating its oxygen.

I have already shown you that spontaneously generated peroxide of hydrogen exists in human fats, and I will now, by means of the same test, which is perfectly reliable, offer you proof of its existence in the fats of mutton and beef, in lard, butter, and cod-liver oil. You will find them all capable of oxidizing guaiacum resin in the presence of blood. I will then proceed to show that the same principle exists in almond, olive, and linseed oils; in the essential oils of turpentine, juniper, lavender, peppermint, and caraway; in common resin, the resin of guaiacum, myrrh, and ether.

It has been stated by Professor Roscoe and other modern writers on chemistry that peroxide of hydrogen does not occur in nature, and I may here venture to state that I claim to have been the first to show the presence of this physiologically interesting principle, not only in fats and oils, but also in a very large number of substances, many of which rank among our most valuable remedial and prophylactic agents.

The importance of fat in the animal economy is now more clearly recognized than it formerly was. Dr. Sydney Ringer, in his well-known work on Therapeutics, says: "Fats are necessary foods to the animal body, being both heat-giving, force-supplying, and plastic. Their combustion contributes mainly to the generation of the heat of the body."

Having demonstrated to you the fact that, apart from the conditions of life, all fats and fixed oils possess the property of absorbing atmospheric oxygen and converting it into peroxide of hydrogen—a substance which, as I have said before, is resolved into water and nascent oxygen when brought into contact with the coloring matter of blood, I will now assume that fats in the living body obey the same chemical laws as they do out of the body, and that the oxygen which has been absorbed by the red corpuscles of the blood during respiration is converted by the fat which is always present in the blood, although in varying proportions, into peroxide of hydrogen; and that the peroxide of hydrogen thus formed is resolved by the coloring matter of the blood into water and nascent oxygen.

EFFECTS OF IRON IN THE BLOOD.

I think it possible that the iron in the coloring matter of the blood may be the principle which decomposes the peroxide of hydrogen and liberates its oxygen, and I will show you an experiment which rather favors this view. The experiment I am about to perform will be almost a repetition of our first experiment, in which I showed you that the oxygen of peroxide of hydrogen, as contained in the human fat, could not, by itself, oxidize the resin of guaiacum; but that on the addition of a mere trace of a watery solution of the coloring matter of blood it did so readily. On this occasion the only difference I shall make will be to substitute a watery solution of perfectly pure protosulphate of iron for the solution of the coloring matter of the blood, and we shall find that the guaiacum resin will be oxidized and turned blue, just as it was by the coloring matter of blood. Protosulphate of iron which has become, even in the slightest degree, oxidized, is unfit for this experiment, as it would then contain ozonic oxygen, and would oxidize guaiacum resin and turn it blue without the intervention of peroxide of hydrogen.

When this peculiar, but at present barely recognized property of fats and fixed oils, becomes more generally known, it may lead to a modification of our present views regarding the functions of fat in the animal economy; and also, perhaps, to a clearer knowledge of the therapeutic influence of fats and oils. Cod-liver oil, by common consent, takes the highest place as a remedial agent among the fats. The ease with which it is digested may, perhaps, be its chief recommendation, for we often find that those who have derived the greatest benefit from its use have been unable to digest other fats. Its therapeutic value is universally recognized in the treatment of phthisis, scrofula, and other diseases in which the functions of oxidation and nutrition are imperfectly performed; and I am disposed to attribute some of its curative properties to the power it possesses of readily carrying peroxide of hydrogen into the circulation, and of thus, by supplying nascent oxygen to the blood, promoting the oxidation and removal of effete tissue, and possibly also of strumous and tubercular matter.

SUBSTANCES WHICH GENERATE PEROXIDE OF HYDROGEN IN THE BLOOD.

To this property of spontaneously generating peroxide of hydrogen, coupled with a power of readily entering the blood when administered internally, may, I think, be ascribed the beneficial action of many other therapeutic agents, some of which experience has shown to be of value in the treatment of diabetes, gravel, rheumatism, and gout, all of which rank among the diseases of sub-oxidation.

Many years ago the use of what was called ozonized cod-liver oil was highly recommended by Dr. Symes Thompson and his father. In twenty cases in which it was administered by the latter gentleman the pulse was reduced more than twenty beats in a minute in eleven, and to a less extent in seven of the remainder. Now, this so-called ozonized oil was nothing more than cod-liver oil which had become highly charged with peroxide of hydrogen in consequence of long exposure to the direct rays of the sun. I may observe that the combined influence of warmth and light greatly expedites the formation of peroxide of hydrogen.

During the last few years Dr. Balthazar Foster, of Birmingham, has strongly advocated the use of etherized cod-liver oil in the treatment of phthisis. Now, here again we have cod-liver oil containing a larger proportion of peroxide of hydrogen than it ordinarily contains, and this is due to its admixture with ether, a substance which possesses a much higher power of generating peroxide of hydrogen than is possessed by oils.

Myrrh is a substance which, in common with the majority of hydrocarbons and oxyhydrocarbons, possesses the property of absorbing atmospheric oxygen and converting it into peroxide of hydrogen; and this property, coupled with the decomposition and liberation of nascent oxygen, which takes place when peroxide of hydrogen is brought into contact with either blood or pus, affords, I think, a tolerably rational explanation of the beneficial action of tincture of myrrh in the treatment of bleeding and spongy gums, and of certain forms of sore throat. It is worthy of remark that pus liberates the oxygen from peroxide of hydrogen much more rapidly than it is liberated by blood. The purifying and stimulating action of common resin, when applied to bleeding or suppurating surfaces, admits of a similar explanation.

Guaiacum resin, once a famous remedy for chronic rheumatism, is still recommended by Dr. Garrod and some other practitioners of eminence in the treatment of this disease. It is, however, rather uncertain in its action, and this may possibly be due to the fact that while some specimens of the resin will generate peroxide of hydrogen pretty readily, other specimens seem quite incapable of generating it, even under the most favorable circumstances for its production. I need hardly say that, for experimental purposes, the alcoholic solution of guaiacum should always be freshly prepared from pure and unoxidized resin.

Oil of turpentine is the last remedial agent to which I shall refer. It possesses in a higher degree the power of generating peroxide of hydrogen than any other substance with which I am acquainted, and this property may account, in some measure, for its great value in the treatment of typhoid fever and other diseases in which free oxygenation of the blood would seem to be desirable.

In conclusion, I would wish it to be clearly understood that I do not for a moment entertain the absurd idea that the property of imparting active oxygen to the blood is the sole virtue possessed by any of the substances I have brought under your notice; but, at the same time, I cannot help thinking that those substances which, from a chemical point of view, may be supposed capable of aiding nature in oxidizing and carrying off the effete materials of the body are deserving of a high rank among our remedial agents.

DIARRHEA IN CHILDREN.

A NOT altogether new, but good and simple, plan of treating infantile diarrhea is recommended by Dr. Black in a late number of the *Journal de Thérapeutique*.

Whatever be the nature of the diarrhea, its origin, its intensity, or the time elapsed since its inception, the treatment which the author proposes, modified according to the cases, and which has constantly been successful in his hands, is as follows:

1st. Diminution of the nourishment; appropriate injections repeated as required; and the application of poultices to the belly.

2d. Administer each morning, for three, four, or five days in succession, a small teaspoonful of a mixture of equal parts of castor oil and sirup of acacia, simply emulsionized by shaking the bottle at the time of giving the medicine.

In order that this medication may produce a curative effect it is necessary to give the mixture in very small doses, and to repeat its employment for several days in succession. Three or four days' running is generally sufficient to modify the nature of the stools and to diminish their number. If after two days' treatment the diarrhea is moderated without disappearing, it should be suspended for a day, and then the same dose should be resumed, but after a day's interval.

THE TREATMENT OF ULCERS WITH A SATURATED SOLUTION OF CHLORATE OF POTASSIUM.

By T. M. ROCHESTER, M.D.

I WISH to call attention to the treatment of ulcers, ulcerations, and suppurating wounds and sores in general, by the use of a saturated solution of chlorate of potassium. I have said suppurating sores in general, and so it will be found beneficial in all of these, but it is especially useful in that particular class of old, unhealthy, indolent ulcers which are one of the opprobria of our art. Let me describe briefly my plan of treatment in one of these cases.

Suppose, for example, a patient comes with an old, indolent ulcer on the leg, which is the most frequent situation. The sore is foul, unhealthy in appearance, and ill-smelling. The limb is usually much swollen, granulation is at a standstill, the ulcer may even be phagedenic, and the discharge is thin, sanious, and offensive. As a rule, the patient has the sore covered with some salve or ointment, and the limb is either bandaged tightly or strapped with adhesive plaster.

In a case of this kind I immediately remove all bandages and constrictions, and direct that they shall not be again applied. The ulcer is then carefully and gently washed with warm water, after which it is ordered to be gently douched five or six times a day with a saturated solution of chlorate of potassium. My usual prescription is: Take of pot. chloratis, 2 drachms; aquæ puræ, one pint. The best method of doing this is to fill a sponge with the solution, and then slowly press it out, holding it within an inch or two of the sore.

After the ulcer has been quite freely douched, a thin layer of the unguentum zinci oxidi should be spread around the edges. It is then to be completely covered with a piece of oiled lint, kept in place by a bandage applied as loosely as possible. The douching should be repeated at first five or six times daily; the zinc ointment need not be used more than twice in the twenty-four hours. At the end of two or three days the ulcer will begin to assume a healthy appearance, and commence to granulate nicely. When this improvement is noticed, the number of douchings should be decreased, otherwise the granulations will become pale and flabby. As the sore fills up and begins to heal over around the edges, the zinc ointment should be increased, so as to cover the new skin. This serves to protect and strengthen it. So, too, it is well to continue its use for a few days after the ulcer has completely skinned over.

Such, in brief, is my mode of dealing with these cases, and it is with the keenest satisfaction that I have watched case after case of unhealthy, indolent, varicose, or specific ulcerations, which have defied one treatment after another, and worn out the patience of physician and patient alike, take on a healthy appearance after two or three days of this treatment, and thence proceed rapidly to a complete recovery. During the past fifteen months I have seen and treated by this plan between ninety and one hundred cases, and in no single instance have failed to see immediate and continued improvement, and, when they could be kept track of, complete healing in from one to six weeks.

This number of cases embraces not only the ordinary indolent ulcers, but also syphilitic, varicose, and one case which I believe was carcinomatous in its character.

Several of my cases had scraping and skin grafting tried in vain. Where they were syphilitic, constitutional treatment had been and was used alone without effect, but rapid healing immediately took place when the douching with the saturated solution of chlorate of potassium was combined with it.

There is another point that is worth mentioning, and that is, that this douching is entirely painless after a few applications. It may smart a little the first or second time, but even then it is so slight as not to be taken into consideration. Now to mention a few cases, as it would only be tedious to give them all. The following are fair samples of the whole, as they are taken entirely at random and not selected at all, with the exception of the first, which is a very marked example of the efficacy of this treatment:

CASE.—C. K., male, aged 29, was sent to the hospital to have the leg amputated at the middle third of the thigh, as a last resort. Had an ulcer three inches by one and a half on the external lateral aspect of the leg. The limb was swollen to twice the natural size, and gangrenous in appearance as far as the lower third of the thigh. The discharge from the ulcer was thin, sanious, and very fetid. There was no history of syphilis, either congenital or acquired. Had been getting gradually worse for over a year, although he had tried almost everything, and seen a number of physicians in regard to it. He walked with great pain and difficulty. The solution of chlorate of potassium was used, and by the third day a decided improvement was noticed. The swelling of the leg had decreased, and the ulcer began to granulate nicely. At this time he had an attack of delirium tremens, which lasted four or five days, but notwithstanding this shock to the nervous system, the leg continued to improve *visibly* from day to day. At the end of four weeks the limb was of the normal size and appearance, the ulcer healthy, and about as large as a three cent piece. The patient could walk without any inconvenience, and insisted on leaving the hospital to fill the position of organist in a Catholic church, although strongly advised not to. He returned after a week or two with the leg slightly swollen, and the ulcer about the size of a silver quarter. The treatment was resumed, and he was discharged cured in ten days.

CASE.—A. G., female, aged 30. Syphilitic. Large deep ulcer on the posterior aspect of leg. Discharge excessively foul and unhealthy. Had tried specific treatment alone in vain. Leg healed nicely in about five weeks under the combined use of constitutional and the chlorate of potassium treatment.

CASE.—M. W., female, aged 65. Syphilitic. An extremely large and deep ulcer, covering nearly the whole of the posterior and external lateral aspects of the leg. Discharge excessively fetid. Rapid and continued improvement for several weeks under the combined constitutional and chlorate of potassium treatment. Lost sight of before complete healing took place.

CASE.—J. H., male, aged 66. Several small but troublesome ulcers along the crest of the tibia. Had been troubled for months. Probably due to a previous injury of the knee-joint. Healed completely in ten days by this treatment.

CASE.—P. M., male, aged 38. Varicose ulcer of leg. Had been troubled for over a year. Healed completely in one week.

CASE.—O. H., male, aged 46. Small indolent ulcer of the leg of many months' standing. Healed in one week.

CASE.—C. K., female, aged 40. Large indolent ulcer of the leg of over a year's standing. Rapid and continued improvement for two weeks. Was then lost sight of.

CASE.—P. N., male, aged 38. Troubled with a large varicose ulcer for several years. Healed completely in three weeks.

CASE.—S. T., female, aged 10. Simple but unhealthy-looking ulcer of several weeks' duration. Healed in one week.

CASE.—M. C., female, aged 40. Varicose ulcer of several years' standing. Healed in four weeks.

CASE.—F. F., male, aged 19. Two large, ragged, deep, and unhealthy-looking sores on the right leg, and a similar one on the left. Discharge excessively fetid. Looked as though gangrene had set in. Healed completely in three weeks.

CASE.—M. M., female, aged 40. Large indolent ulcer of the leg of several years' standing. Healed in five weeks.

CASE.—L. C., male, aged 41. Troubled for years with an indolent ulcer of the leg. Had tried almost everything—among other means, skin grafting—but without benefit. Healed in two weeks.

And so I might go on and enumerate case after case, but I think the above are sufficient to prove the efficacy of this plan of treatment. I wish, however, to quote one case, as showing the advantage in the use of the saturated solution of chlorate of potassium in recent injuries when the suppuration is profuse.

CASE.—H. B., male, aged 28, of fine muscular development. Received a penetrating lacerated wound of the arm, which severed the brachial artery. The hemorrhage was controlled by acupressure both above and below the wound. On the removal of the needles a large slough came away, and the suppuration was excessive and very exhausting. The solution of chlorate of potassium was used, the excessive flow of pus was checked, the fetor arising from it allayed, and the patient rapidly convalesced.

One word as regards the mode of operation of chlorate of potash thus used. I do not know that I am right, but my theory is as follows:

1st. Its astringent properties cause it to repress exuberant granulations, or to stimulate their growth when they are absent or ill-formed.

2d. As an antiphlogistic it moderates the inflammatory action.

3d. And this I regard as the most important: as an antiseptic it destroys and prevents the growth of bacteria.

This threefold action I believe meets all the indications for the local treatment of this troublesome class of afflictions. In conclusion, let me say that this use of chlorate of potassium is not my own discovery, but was suggested to me while *interne* at the Monroe Co. Hospital by the attending physician, Dr. Azel Backus, of Rochester, who has used this treatment successfully in his practice for years.—*Proceedings Med. Soc. Kings Co.*

NEW METHOD OF DETECTING ARSENIC.—The substance in question is mixed with a little water, or its solution is poured into a small beaker, and a piece of sodium amalgam as large as a grain of wheat is introduced. The beaker is then covered as rapidly as possible with a piece of white filter paper or a porcelain lid, previously moistened with a weak feebly acid solution of silver nitrate. The presence of arsenic is indicated by a blackening of the paper or of the porcelain. As antimony hydride is not given off—or in mere traces—from strongly alkaline liquids, the solution should be rendered distinctly alkaline. In this manner the confusion of antimony and arsenic is rendered improbable, though not quite excluded. Organic matter does not interfere.—*Archiv Pharm., American Journal of Pharmacy.*

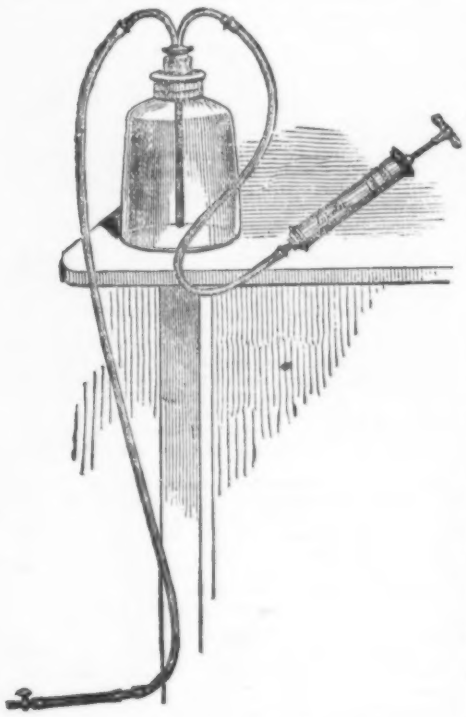
THE *Chemiker Zeitung* reports that the Wesenberg Chiccory Works of Berlin were burnt to the ground on the 4th Sept. May every other chiccory works follow suit!

EMBALMING THE DEAD.

THE modern method of embalming is very rapid and simple when it is compared with the ancient.

A large artery of the dead body is exposed and opened, and into the vessel a hollow needle is inserted. The needle is firmly tied in its place. Through the needle a solution of chloride of zinc is injected slowly until it has found its way over every part. The principal art that is required in this process is to be very careful not to use too much force in driving the fluid into the tissues and in not using too much fluid. The fluid which answers best is made as follows: Into two pints of water, at 50° Fahr., add chloride of zinc slowly until the water just refuses to take up any more of the salt. Then add one pint of water more and two pints of methylated spirit. The five pints so produced are a sufficient quantity for embalming an adult body. The solution can be injected quite cold, and it will find its way readily over the vessels. If expense be not considered, pure alcohol may be used instead of the methylated spirit. The effect of the solution is shown by its making the surface of the skin white, firm, and, for a short time, slightly mottled. The apparatus necessary is extremely simple, and lies on the table. It consists of a small ordinary anatomical case, and of an injecting bottle and syringe, which has been constructed on my directions by Messrs. Krohne & Seseman, of Duke street, Manchester square.

The diagram shows the apparatus ready for use. The bottle will hold six pints of fluid, but it need not be quite filled. The neck of it is fitted with two tubes, which make it act like the common wash bottle of the laboratory, so that when, through the tube on the right hand side, air is forced



through the syringe which is attached to the tube, the pressure on the surface of the fluid forces the fluid up the long tube in the bottle and over the tube on the left-hand side. The left-hand tube terminates in a stop-cock, to which the needle that has to be inserted into the artery is joined. The tube leading to the bottle is of India rubber, of an eighth of an inch bore, and may be several feet long. Before the arterial needle is tied in the artery the stop-cock is turned off, that no fluid may pass. When the needle is fixed the stop-cock is opened, and the bottle is raised on a table three feet above the level of the lower end of the injecting tube. As a rule, the fluid will now descend by its own weight and gravitate all over the body, but if it fail to do this the pressure of the syringe for a short time will be sufficient to carry on the current.

When the fluid has slowly diffused, until it has been all passed into the vessels, a pint of solution of silicate of soda may be injected with a syringe through the artery, by which the structures will be rendered very black, the silicate undergoing a firm coagulation in contact with the zinc. This final plan is, however, not really required. It is, as a rule, merely necessary to remove the hollow needle from the artery, tie the artery above and below the place where it has been opened, and merely close the opening that has been made. The operation is now complete. There is nothing in it of a kind to give rise to any of the sensational stories which have been raised in regard to it, that is to say, when it is properly conducted. It is not more objectionable than the ordinary examination of a body to discover the cause of death.

B. W. RICHARDSON, M. D.

NEW WAYS OF UTILIZING THE ACTION OF ALKALIES AND ACIDS ON THE TEXTILE FABRICS.

THE destructive effect of acids on vegetable fibers and of alkalies on hair is variously taken advantage of in the arts. In the line of improvements in this direction, Profs. Rissmüller and Wiesinger, of Göttingen, Germany, have lately introduced a process well worth being mentioned. Woolen rags and similar refuse containing partly animal, partly vegetable fibers, were so far usually converted into cyanides. Hereby only a part of the nitrogen was obtained in a form fit for further use, while the vegetable fiber or cellulose was utterly destroyed and lost. According to this new process, the nitrogenous matter is obtained in the most convenient form for use as a fertilizer, while the condition in which the vegetable fiber is obtained qualifies it highly for use in the manufacture of paper.

Four kg. of slaked lime are mixed with 200 to 300 kg. of water and heated in an iron boiler to 100° C. Into this liquid are introduced 50 kg. of the rags or refuse to be treated and kept for about an hour at the boiling point, when they may be removed from the bath, pressed, and dried. The nitrogenous matter contained in the rags has by the action of the lime been altered so as to form a brittle mass when dry, which may be easily rubbed into powder. A small portion has been converted into ammonia and a smaller portion still has been dissolved. The vegetable fibers or cellulose contained in the fabric (linen or cotton) remain fully intact and may be mechanically separated from the nitrogenous matter by grinding and sifting, or other means. The nitrogenous matter is thus obtained as a fine powder, the cellulose in clean but otherwise unaltered condition.

The powder is very rich in nitrogen, and is a very good fertilizer when the lime retained has been neutralized by sulphuric acid. It serves to introduce into the soil the necessary quantity of nitrogen. All the nitrogen contained in the wool becomes thus readily available, the quantity lost by conversion into ammonia and retained in solution being inconsiderable. The very fact that in boiling already the decomposition of nitrogenous matter takes partially place is a guarantee for the superior fertilizing qualities. In this respect the powder obtained is equally as good as sulphate of ammonia. The linen and cotton fibers obtained are valuable for the manufacture of paper, while heretofore they were destroyed. Thus the entire material may be converted into highly useful forms at a very low cost.

In a similar manner as the lime acts on animal fibers, acids act on vegetable substances; hence the use of sulphuric and muriatic acid for carbonizing woolen goods. These acids are, however, in their usual form too harsh and destructive in their effects, burning the goods, and hence numerous methods have already been recommended to overcome this difficulty. Dr. A. Frank now recommends the use of the chloride of magnesium. This salt is contained in the waste waters of many chemical, especially potash works, and can be obtained at a moderate cost. Dr. Frank used a solution of 1·10 sp. gr., in which the goods are thoroughly soaked. They are then freed of the greater portion of the liquid by means of centrifugal drainers and dried at 100° C. They are then brought into the carbonizing chamber, in which they are kept for an hour at a temperature of 130° C. The chloride of magnesium enters at that temperature into a mutual decomposition with the watery vapor present, forming muriatic acid and hydrated magnesium oxide. As the acid is only generated gradually, it exercises its influence by degrees only and less harshly than when otherwise applied. The goods are thus thoroughly carbonized without being injured in the least. They are passed yet through a diluted solution of hydrochloric acid, to remove the adhering magnesia, and rinsed with pure water.

SULPHURIC ACID CHEMISTRY.

ONE characteristic property of sulphuric acid, that of "charring" various substances, such as linen, straw, paper, sugar, etc., is due to the intense affinity which this reagent possesses for water. The old experiment of pouring oil of vitriol into strong sirup in a capacious cylindrical vessel perhaps illustrates this property in the most striking manner. Sugar, as well as the other substances mentioned above, consists of carbon, hydrogen, and oxygen, the two latter being present in the same proportions, with regard to each other, as in water. All such bodies are classed together as "carbohydrates." The sulphuric acid, when added to the carbohydrates, unites with its hydrogen and oxygen, so that the black carbon being set free, the substance is said to be charred.

Most organic substances contain hydrogen and oxygen, though the proportions of those elements are not in most substances those in which they occur in water and carbohydrates. Two or three instances of the action of sulphuric acid upon organic substances will be of interest.

One familiar substance is oxalic acid. This has the formula $H_2C_2O_4$, and it is decomposed by sulphuric acid in consequence of the affinity of the latter for water. When the hydrogen has been removed, together with as much oxygen as is required to form water (H_2O) sufficient oxygen (3 atoms) still remains to convert one carbon atom into carbonic acid gas (CO_2), and the second into carbonic oxide (CO), so that no charring takes place.

The equation is:

$$\underset{\text{Oxalic acid.}}{H_2C_2O_4} = \underset{\text{Water.}}{H_2O} + \underset{\substack{\text{Carbonic}\\\text{Acid Gas.}}}{CO_2} + \underset{\substack{\text{Carbonic}\\\text{Oxide.}}}{CO}$$

This reaction affords chemists a ready mode of preparing carbonic oxide, the mixed gases being first passed through a wash bottle containing a caustic alkali, which retains the CO_2.

It is very seldom that sufficient oxygen is present in an organic substance to unite with both the hydrogen and the carbon as in this case; and on this account it is that a portion of the carbon generally separates in a solid form, as the oxygen first supplies the hydrogen, in order that the water formed may unite with the excess of sulphuric acid employed.

When alcohol and sulphuric acid are mixed and the mixture heated, the results differ, as might be expected, according to the different proportions of the constituents. Alcohol (C_2H_6O), if it be mixed with a large quantity (five or six times its volume) of sulphuric acid, loses the whole of its oxygen, together with the amount of hydrogen necessary to form water, splitting up, therefore, as follows:

$$\underset{\text{Alcohol.}}{C_2H_6O} = \underset{\text{Ethylene}}{C_2H_4} + \underset{\text{Water.}}{H_2O}$$

This ethylene (C_2H_4) is also called ethene and heavy carbureted hydrogen. It burns with a very bright flame, and forms the principal illuminating constituent of ordinary coal gas.

If we now mix these two, alcohol and sulphuric acid, in almost similar proportions by volume, 10 parts of rectified spirit to 12 volumes of acid, and have an arrangement for preventing these proportions being altered, by running spirit in as rapidly as it is decomposed, the result is different. As the ultimate product we obtain ether, $C_4H_{10}O$, which we may consider is derived from alcohol by abstracting *half* the oxygen, together with as much hydrogen as is necessary to the formation of water, two molecules of alcohol being needed, thus:

$$\underset{\text{Alcohol.}}{2C_2H_6O} = \underset{\text{Water.}}{H_2O} + \underset{\text{Ether.}}{C_4H_{10}O}$$

This, the ultimate result, we may see to be in accordance with what we should anticipate, viz., that the proportion of sulphuric acid being reduced, the amount of water abstracted from the alcohol is less than in the former instance.

It is necessary, however, to remember that this ultimate result is not attained at once, but in two stages; part of the sulphuric acid itself being decomposed in the first, and regenerated in the second stage. The first reaction consists in the displacement of one hydrogen atom in the sulphuric acid molecule (H_2SO_4) by the "radical" ethyl (C_2H_5), of which alcohol (C_2H_5HO) is the hydrate. Thus a body, having the formula $C_2H_5HSO_4$, and called ethyl sulphuric, or sulphovinic acid, is formed. The equation representing this is:

$$\underset{\text{Alcohol.}}{C_2H_5HO} + H_2SO_4 = \underset{\substack{\text{Ethyl Sulphuric}\\\text{Acid.}}}{C_2H_5HSO_4} + H_2O$$

This ethyl sulphuric acid is then decomposed, as well as a second molecule of alcohol, ether and sulphuric acid resulting:

$$C_2H_5HSO_4 + C_2H_5HO = \underset{\text{Ether.}}{(C_2H_5)_2O} + H_2SO_4$$

The differing action of strong and dilute sulphuric acid upon copper, iron, etc., will be alluded to subsequently when treating of the action of acids generally upon metals. We will close this chapter by the further instance, of great importance to the pharmaceutical student, of the different actions of strong and dilute sulphuric acid upon yellow prussiate of potash, or more correctly, ferrocyanide of potassium, $K_4Fe(CN)_6$.

The difference in this case is *not* so clearly due to the avidity with which oil of vitriol absorbs water; indeed it is not very clear to what special cause we can attribute it; probably the different degree of heat to which the mixtures are subjected has something to do with determining the reaction.

When dilute sulphuric acid is heated with potassic ferrocyanide, a comparatively simple change takes place, a "double" salt, ferrocyanide of potassium and iron, sulphate of potassium and hydrocyanic acid being formed, the reaction being in accordance with the following equation:

$$\underset{\substack{\text{Potassium}\\\text{Ferrocyanide.}}}{2K_4FeC_6N_6} + 3H_2SO_4 = \underset{\substack{\text{Ferrocyanide of}\\\text{Potassium and Iron.}}}{K_2FeFeC_6N_6} + 3K_2SO_4 + \underset{\substack{\text{Hydrocyanic}\\\text{Acid.}}}{6HCN}$$

The hydrocyanic acid being volatile, while the other products are "fixed," if the operation be conducted in a retort, the acid may be distilled off, and in this manner the Pharmacopœia directs the dilute hydrocyanic acid of pharmacy to be prepared,

If now the undiluted acid be heated with this salt the products are very different; the connection between the carbon and nitrogen, strong enough to remain unbroken when the dilute acid was used, is here completely severed, the carbon coming off as carbonic oxide, and the nitrogen in the form of an ammonia salt. The *exact* reaction will depend upon the proportion of acid and the extent of heating; the following equation may be regarded as an approximately correct picture of what usually takes place:

$$\underset{\substack{\text{Ferrocyanide}\\\text{of Potassium.}}}{K_4FeC_6N_6} + 6H_2SO_4 + 6H_2O = 2K_2SO_4 + FeSO_4 + 3(NH_4)_2SO_4 + \underset{\text{Carbonic Oxide.}}{6CO}$$

The products may be shortly stated as the three sulphates (iron, potassium, and ammonium) and carbonic oxide; and the process is frequently employed by chemists as a means of obtaining pure carbonic oxide.—*Monthly Magazine.*

INFLUENCE OF VIBRATORY MOTION ON SOLUTIONS OF GASES AND EXPLOSIVES.

THE tendency of vibratory motion to disintegrate loose chemical combinations of elements and solutions of gases in liquids is well known, although little attention has been paid to this subject so far. Mr. D. Gernez has of late made further experiments in this direction, and reports on them in *Comptes Rendus* as follows:

Supersaturated solutions of gases may be kept in narrow glass tubes for a considerable length of time without any change, provided there are no particles of free air or gas adhering to the walls of the tube, although the latter be left freely open within an atmosphere containing only traces of such a gas.

The gas only separates from its solvent at such spots, where the latter comes in direct contact with gaseous bodies; the evolution of gas thus only takes place at the surface, by way of an exchange from stratum to stratum. The portion of liquid next adjoining the surface loses its gas first and takes up, instead, a quantity of gas from the portion next below. At a constant low temperature the process advances very slowly. I kept ordinary carbonic acid water in this manner for several months, without noticing any apparent change. On introducing bubbles of gas into the solution, each bubble causes a lively development of gas, its activity increasing with its size.

Most interesting is the effect of the vibratory motion of sound on such solutions. If a tube about 3 feet in length and ½ of an inch in diameter, *perfectly clean*, be filled with carbonic acid water and firmly held in vertical position, while the lower end is rubbed with a moist rag, so as to cause a weak sound, the gas will separate in copious bubbles, increasing in size and number so as to throw forcibly out of the tube a portion of the liquid.

Similarities previously observed between concentrated solutions of gas and certain explosive substances induced me to investigate the effects of vibratory motion also in regard to the latter.

We are acquainted with a number of easily decomposing liquid and gaseous bodies, such as the oxides of chlorine, the nitro-compounds, etc. Of these I selected for various reasons the nitrous acid obtained as a blue liquid when hyponitric acid is slowly added to water of 0° C. For this purpose a glass tube 3 feet in length and ¼ of an inch in diameter was thoroughly cleaned by successive applications of caustic potassa, boiling water, hot sulphuric acid, boiling alcohol, and distilled water. The tube was then filled with boiling distilled water and cooled down to 0° C. Hyponitric acid was added drop by drop. A blue stratum of nitrous acid was readily formed in the lower part of the tube, covered by a colorless stratum of nitric acid. The tube was now cautiously warmed to 20° C., no sign of decomposition being noticeable. On causing the tube to sound, however, by friction, the acid at the bottom was instantly decomposed, the liquid being forcibly thrown out from the tube to a distance of nearly ten feet, by the nitrous oxide gas generated. The extreme violence of the reaction is due to the fact that the dissociation of the molecules forming nitrous acid gains in energy progressively with the number and surface of the minute gas bubbles separated by vibration, and is materially favored by the heat produced by the decomposition.

Superheated liquids commence to boil under the influence

of vibratory motion. Liquids boiling at a point above ordinary temperature are not well adapted to experiments: better suited are liquids boiling at a very low temperature. The general mode of procedure remains unchanged. The liquids operated with were chloride of ethylene, which boils at + 11° C., but may, under circumstances, be heated to 23° C., without boiling; sulphurous acid, boiling at — 11° C., but in the experiment retained in liquid form even at + 10° C., and chloride of methylene, which is now easily obtainable in the market and boils at — 23° already. The latter substance was found to be preferable for experimental purposes. A tube, as described above, was well cleaned and the chloride of methylene poured into the same through a funnel and filter. A small quantity evaporated and thereby cooled thoroughly the tube and funnel, the tube filling up now rapidly. As the chloride evaporates only at the surface, the latter does not sink over ½ of an inch within an hour, the cold produced by the evaporation being sufficient to keep the temperature below the normal boiling point of the chloride. The temperature rises very slowly, especially when the surrounding air is very dry. In moist air the watery vapor condenses in the shape of snow on the tube and melts again gradually. When, at this stage, the tube is caused to sound ebullition sets in immediately, but does not last very long and does not force any liquid out of the tube. The short duration of the reaction in this case is explained by the rapid reduction of temperature in consequence of a large quantity of heat becoming latent by evaporation.

PEDESIS.

PROF. DR. JEVONS, in London, has discovered that very minute particles of animal, vegetable, and inorganic substances, when suspended in water, persist in a peculiar, at intervals, trembling motion, provided the particles do not exceed 1-5000 inch in diameter. The duration of the single movements is from 1-15 to 1-20 of a second. Especially distinctly noticeable is the motion when silicates, as very finely levigated kaolin, are suspended in distilled water. All bodies soluble in water have, with few exceptions, the property to prevent the motion, or "Pedesis," as Prof. Jevons has called it. By 1-1000 part of sulphuric acid pedesis is stopped completely, while 1-1000.00 part already weakens it considerably. Gum arabic in solution however tends to increase the motion. (N. B. The Greek word "pedesis" means "jumping motion.")—*Aug. Polytech. Zeit.*

SPURRED RYE IN BREAD.

ACCORDING to Dr. Hofmann, flour derived from ergot (spurred rye) may be detected in bread as follows: Thirty grammes of the suspected bread or flour are macerated for twenty-four hours with a mixture of 40 grms. of ether and 20 drops of diluted sulphuric acid. The liquid obtained is shaken with a concentrated solution of bicarbonate of sodium. In case any ergot be present, the solution will acquire a peculiar violet color, as little as 0·1 per cent. of ergot being readily detected.

TESTING FLOUR FOR MINERAL ADMIXTURES.

HIMLY recommends to shake a sample of the suspected flour in a test tube with chloroform. On standing the flour will gather and form a distinct stratum under the surface of the chloroform, while the heavy mineral parts sink to the bottom. It must, however, not be forgotten that even the best flour may contain a quantity of a heavy brown substance, which is nothing else than particles of stone, derived from the grindstones.

TESTING SUBNITRATE OF BISMUTH FOR LEAD.

As subnitrates of bismuth, especially some English and French samples, have lately been found to contain lead, the following will be found an easy and reliable test for the same. A small quantity of the nitrate is boiled with caustic soda, dissolved in a solution of yellow chromate of potassium. In case lead be present, the filtered liquid produces, on addition of a little acetic acid, a yellow precipitate of chromate of lead.

NEW TEST FOR ALKALIES.

FRESH orange peel is cut in small pieces and macerated in alcohol for 24 hours. From the resulting yellow tincture the ethereal oil is separated by ether. The remaining tincture forms, when mixed with water, a colorless solution, which turns yellow on the addition of alkalies, but is not affected by acids. This test gives also good results in presence of ammonia salts (free ammonia of course excepted).

COBALT PLATING.

A. GAIFFE recommends, in *Comptes Rendus*, the use of a solution of the double sulphate of cobalt and ammonia. A piece of platinum foil may serve as anode, but it is best to use a piece of cast or hammered cobalt. As soon as the entire surface of the article to be plated appears white, the strength of the current must be reduced one-half. Hereby a brilliant, beautiful coating is obtained, which is very hard and adheres firmly.

EMAIL FOR CAST IRON.

THE *Metallarbeiter* recommends the following composition for email for cast iron: Feldspar 500 parts, fluorspar 500 parts, borax 70 parts, carbonate of sodium 70 parts, oxide of tin 35 parts.

RECOVERING GOLD FROM OLD CYANIDE SOLUTIONS.

THE solution is saturated by muriatic acid, whereby hydrocyanic acid is generated and part of the gold precipitated. The gold is collected on a filter, and from the filtered solution the rest of the gold is precipitated by zinc. Both precipitates are fused with five times their volume of calcined soda to unite them to a regulus.

COLORING RIFLE BARRELS BROWN.

THE following is a process practiced at the Vienna Arsenal. The clean, polished barrels are brushed over three times with a solution of nitrate of silver (1 : 500), and exposed to the air and light after each coating. Another process consists of mixing 2 grms of chloride of antimony with 10 drops of olive oil, rubbing with this mixture the previously warmed iron and exposing to the air. In both cases the barrel must finally be rubbed with wax and polished.

A NEW ALKALOID.

ONE of the most valuable remedies for tapeworm is the bark of the root of the pomegranate shrub, and the only reason for which its use has not become more general is the fact that only in the fresh state the root is effectual, losing its remedial properties very soon after drying. Tanret has now succeeded in obtaining from the root its active principle, which he called Pelletierine, as an alkaloid in form of a colorless liquid; being easily soluble in water, ordinarily colorless, but turning brown on exposure to the air, of 0·999 specific gravity, turning the plane of polarization to the right and producing intensely green solutions on the addition of sulphuric acid and bichromate of potassium. Its chemical equivalent has been found to be $C_8H_{15}NO_2$, being another instance of a vegetable base containing oxygen. There may be a possibility of thus obtaining the valued remedy in a form obtainable at all times and seasons.—*Repert. d'Pharm.*

NEW MODE OF DETERMINING THE MELTING TEMPERATURE OF SOLIDS.

ACCORDING to Carnelly the substance is heated over a Bunsen burner in a tared platinum crucible to the melting point, and the crucible immediately placed in a quantity of water of known weight and temperature. The increase in temperature of the water is then measured and the temperature of the crucible calculated according to the equation for specific heat. The temperature of the crucible is here considered as corresponding to the melting point of the substance, which might not be correct in all cases.

CHLOROPHYL.

By A. H. CHURCH.

DURING some inquiries, which have now extended over three years, into the nature of the red pigment of beet-leaves, I obtained as a by-product a considerable quantity of crude chlorophyl. It had been extracted by means of ether from some hundreds of the dried leaves of a red-leaved variety of the garden beet. After removal of the ether the residue was exhausted with cold alcohol of 85 per cent. in order to effect at least a partial purification of the chlorophyl. The chlorophyl from the alcoholic solution was dried *in vacuo* over oil of vitriol, light being excluded. The product was not of a very satisfactory color, and was left for a time without further attention. After the lapse of a few months the mass had become of so unpleasant an olive-brown hue that any idea of further work upon it was abandoned. But after some consideration it seemed a pity to throw away a substance which had been obtained with so much labor. And it struck me that some clew to the constitution or relationships of chlorophyl might possibly be secured by submitting my product, altered though it seemed to be, to the process of destructive distillation in contact with zinc dust. Accordingly the dark mass of chlorophyl was mixed with four times its weight of zinc powder, and placed in the water oven for an hour or two. To my surprise its green color was not merely restored—it became far more intense and characteristic in hue than the best sample of leaf green I had ever before seen. The red fluorescence and spectral bands of its alcoholic solution were, moreover, those of the unchanged pigment. It would, therefore, seem that the gentle reducing action to which the pigment had been submitted when warmed with the metal in the presence of moisture had brought it back to the state in which it existed prior to its removal from the plant and exposure to the oxygen of the air. I trust to be able to pursue this promising line of research. After all, my original intention was carried out, and a considerable portion of the brilliant green mass still containing zinc (together with some sand to prevent frothing) was distilled in a current of dry hydrogen. It yielded about 30 per cent. of its weight of an oily distillate, the less volatile portions of which solidified into a crystalline mass on cooling. Ether dissolves this distillate with a blue fluorescence; caustic soda solution does not appear to dissolve or affect it. It seems to be a mixture of not less than three substances, possibly hydrocarbons, but as yet not identified.—*Chemical News.*

WHEAT CULTURE.

THE following address, made by a prominent miller of Indianapolis, shows how nearly connected the farmer's interests are with those of the miller. Mr. Gibson is a live miller, who has a reputation for making good flour, which is backed by a good mill, and is alive to all the interests connected with his trade:

GENTLEMEN:—I am here by invitation to talk about the cultivation of wheat. Since I left the farm, which was a good many years ago, my business, flour-milling, has necessarily interested me in the production of wheat. I do not claim to be able to instruct any one as to the best method of wheat production, as that has got to be discovered and demonstrated by experiments to be made by yourselves. If I can, by any hints or suggestions, assist in starting you on the right road, I will have done all I expect. The importance of the wheat crop in our State to all of us can hardly be overestimated. As stated in the report of the State Auditor, the farms of Indiana contain twenty-two million five hundred thousand acres of land. Ten million one hundred thousand acres are under cultivation, and according to the best data I can get, two million acres were in the wheat crop which was harvested this year of 1878. I estimate the average yield per acre at fifteen bushels, which would be an aggregate of

THIRTY MILLION BUSHELS,

produced in our State this year, which is worth say 80 cents per bushel. Its money value would be $24,000,000. Allowing for home consumption 10,000,000, which is five bushels to each person (our present population being say 2,000,000) and 3,000,000 bushels for seed this fall, leaves 17,000,000 bushels for export, to supply the wants of other parts of our country and the world where wheat cannot be so profitably raised as here. Now, what I claim and firmly believe is that the average product can be raised to

TWENTY BUSHELS PER ACRE,

with a reasonable amount of additional knowledge and skill.

The question is, How can this be done? It is known to all that a good growth of clover turned under and ground well prepared hardly ever fails to produce a good crop, and as far as it goes nothing better can be suggested. In this case the product can, probably, be largely increased by the use of an alkali. Wood ashes would answer the purpose for experimenting, but cannot be had in sufficient quantities for extensive use; but if this is found to be beneficial, Kaint, or German potash, can be had in any quantity desired at the seaboard cities. It is mined in Germany and can be bought at seaboard at about $10 per ton; cost here say $15 per ton. The effect of an alkali on the soil is to decompose more perfectly parts of the vegetable matter and put it in condition to be taken up by the growing wheat plant. It also has the effect to dissolve the mineral matter in the soil, and enable the plants to take up such portions of it as are needed to produce a perfect growth of both straw and grain. The preparation of the mineral matter, I think, is the most important. It is well known that wheat sown on rich loam, or on land made very rich by the use of stable manure, produces a heavy crop of soft straw and a small yield of very poor imperfect grain. The reason is that these naturally, or artificially, rich soils contain too little mineral matter in a condition to be taken up by the plants. Therefore when wheat is sown on very rich land, enough alkali should be used to dissolve the mineral matter in the soil and produce

A PERFECT GROWTH OF STRAW AND GRAIN.

The kind that is best and manner of its use must be found out by experiment. We all know that wheat sown on corn hardly ever produces a good crop, either in quantity or quality. The reason, I think, is that so much of the mineral matter has been taken up by the corn that not enough is left to produce a healthy growth of wheat; if this is correct, the remedy is to use alkali in some form to dissolve the mineral matter and put it in condition to be taken up by the wheat plant and produce a perfect growth of straw and grain. If this proves to be correct it is an important matter, as it is so often convenient and necessary to sow wheat in corn that it is constantly done with the certain knowledge that the wheat crop will be a poor one. The burning of the straw on the field on which it was grown, together with the stubble, has proved beneficial. It furnishes alkali and mineral matter that is needed, and also destroys the germs of insects that are always threatening the injury or destruction of the wheat plant, during its growth and ripening. What I have said applies to land that is rich enough, or too rich, for the perfect growth of which there are large quantities in this part of our State, manures and stimulants are needed. Clover cannot be successfully grown on poor clay soils, on account of the action of the frost, pulling the roots out of the ground, and some other method must be resorted to, to produce a perfect growth of the wheat crop. For this purpose experience has proven that

BONE DUST OR GROUND BONES

is the very best and most effective substance. It contains, in a concentrated form, the very elements that are needed, lime and phosphorus. I am informed that about 200 pounds per acre is the usual quantity sown, and that the results are astonishing, and the pay several hundred per cent. This experiment any one can try at a very small expense, by putting it on one or more lands in the field, leaving it off the remainder, and noting the difference in yield between the part so treated and the same quantity of land where it has not been used. It is largely used in England, Europe, and of late years, to a considerable extent, in the Eastern States.

The cost of bone meal is about $1.50 per hundred pounds. I understand it is manufactured in Indianapolis, and most of it is shipped to the seaboard States and to Europe, where its use and value are better known and appreciated than here. The fact is that our lands are naturally so rich and productive that, until lately, we have not felt the want of artificial manures, nor anything, except what nature has furnished, and other people in other sections, where the soil is poor and the climate less favorable, have been

GROWING RICH ON WHEAT WE HAVE WASTED,

but we have probably gone far enough in that direction, and will now begin to utilize the things which we have heretofore overlooked. Most of you have noticed that cattle, when grazing on an old field, if they come to the bleached bones of a dead animal will chew and suck at them with great perseverance. This is an effort to obtain the phosphates in the bones, which their systems require, and which is lacking in the herbage of an old field. It may be that what is called phosphate rock, which is mined in large quantities near Charleston, S. C., would be a valuable manure for our wheat fields. It is exported to Europe by hundreds of ship loads every year. It is mostly gypsum or land plaster, but contains a large percentage of the bones of marine animals. It sells for about $15 per ton, on cars at Charleston, and I think would be well worth trying. Common

LAND PLASTER,

or gypsum, which is found plentifully in our own and other States, has been found beneficial in cases where the soil was deficient in lime, but in most cases our soils are well supplied with lime, either by the gradual decay of the limestone gravel, which is a part of the formation of our second bottom lands, or the limestone formation of the hills of the Ohio river and its tributary streams. Land that is partly made of the decay and wear of a sandstone formation, would, no doubt, be benefited by the application of land plaster, but not our limestone land. Twenty years since the Genesee valley of New York was celebrated for the choice quality of white wheat produced there, and the flour produced from it commanded the highest price in New York; but ten years since the production began to fail. It was preyed upon by all kinds of insects and grew from bad to worse, until the cultivation of wheat was almost abandoned. Within the last three or four years wheat growing has revived, and they are producing larger crops than we of the West, forty bushels per acre not being an unusual yield. I am told that the principal cause of the increased production is the free use of land plaster, which is found in large quantities along the Erie canal.

In Maryland the production of wheat has been largely increased of late years, and I am informed that this was brought about by the State authorities employing first one scientific and practical man to go through the State and examine and analyze the different soils, and find out what they needed for the more perfect growth of crops. In nearly all cases what was lacking in any one soil was found near by in some other soil, and the farmers in adopting the suggestions of the scientist found great benefit, and now the State has three such men employed. Indiana might do the same thing, if her people think it the best plan to get us started on the right road; but, in time, there is no reason why the farmers themselves may not be the best of scientists, and the most practical of men.

AGRICULTURAL LIFE.

When the fact becomes generally understood that learning and scientific knowledge is as necessary and valuable in farming as in any one of the so-called learned professions, the sons of the present generation will not be so anxious to become merchants, lawyers, physicians, etc. These professions are necessary and very useful, but they are becoming

crowded, and when there is a surplus they are of no earthly use as far as I know. Besides, I think farming a much more dignified and independent business than any other. If necessary the daughters can learn the scientific part and the sons the practical, or, if women's rights are to prevail, I have no objection to the women taking to the plow and hoe and becoming the commanders-in-chief of farmers. But I have digressed from the main question. I will go a little further, and say that I think they can exert a much greater influence by remaining commanders-in-chief of the household. Good cooking is much more important to families and communities than good doctoring, and quite as difficult to learn thoroughly. Good housekeeping contains as many eloquent sermons as good preaching, and exercises a much wider influence, because there is a great deal more of it. The husbands, brothers and lovers will always try to be good if properly trained, fed and managed by their wives, sisters and sweethearts.

PREPARATION OF THE LAND AND THE KIND OF SEED.

I will get back to the main question, wheat. I need not tell you that flat, wet, undrained land will not produce good crops of wheat, or anything else. The seed should be frequently changed in neighborhoods from clay to gravelly soils, and sand to loam, and *vice versa*, and less frequently it should be changed to and from different and more distant parts of the country, and we should bring our seed from points south of us, say as far south of us as good wheat will grow. The reason for this is that, say in Tennessee, the wheat ripens ten days earlier than here, and seed brought from there and grown here will attempt to ripen at the same time that it did in Tennessee, which it cannot quite do, but will come a few days earlier than if grown from native seed, and early ripening wheat is always safer from disaster than that which ripens late.

As to the best kinds of wheat for our soil and climate, I say confidently, bearded red wheat—the best and most important of which is the Mediterranean. It comes through the freezing and thawing of weather better than any other known variety. It thrives well on all kinds of soil except that which is too rich. It resists the action of hot weather, rains and insects, and ripens early. It has never yet deteriorated in the quality of the grain, though it has been the leading variety grown here for at least twenty-five years. The berry contains more gluten in proportion to starch than any other winter wheat. When properly manufactured into flour it makes stronger and whiter flour than any amber or white wheat, and a given quantity of the flour will make more pounds of bread of whiter color and containing more nutrition than that from any other wheat. The varieties called Swamp and Lancaster I take to be Mediterranean wheat raised in some distant part of the country for a few years and brought back under new names. I know of no difference between the value of these and the Mediterranean. The amber or smooth red wheats often do well here for, say, two or three years, and give a large yield of good grain per acre, after which they begin to deteriorate, and grow worse in quality and less in quantity from year to year, until they become utterly worthless and lose money for all who put confidence in them. The same may be said of the white wheats, with the addition that they are still more delicate and dangerous than the amber varieties.

AVERAGE PRODUCTION.

The average production of wheat per acre in this State is about twelve bushels. The average of exceptionally bad years, for instance 1875, was about eight bushels per acre. The average of exceptionally good years, say 1864 and 1878, is about fifteen, or may be sixteen bushels per acre. The range this year is from forty bushels down to ten bushels, very few of either the highest or lowest. Quite a number as high as thirty-five bushels, more of thirty to thirty-two, and still more between twenty-five and thirty, and the great majority between sixteen and twenty bushels per acre. The fact that forty bushels, and even more, per acre is produced without any unusual effort or outlay proves that more of it, or even better, can be done with special and well directed efforts and reasonable additional outlay for labor, and such manures and fertilizers as prove to be needed, or are the best for the purpose. If five bushels per acre can be added to the average production of our wheat crop, it means 10,000,000 of bushels per annum, or about that many dollars added to our wealth each year. Suppose that 25, or even 50 per cent. of this amount is paid out for fertilizers and additional labor, the amount so expended is paid to our neighbors, and we still have a net gain of about $5,000,000, a sum not to be disregarded by even wealthier States than ours. I think this a moderate estimate; and that the average increase can be made ten bushels per acre. If a farmer can produce twenty-five to thirty-five bushels of wheat per acre the price is never so low but that he makes a large profit. If he produces only ten to fifteen bushels per acre the price is seldom or never high enough to make even a small profit. Our soil and climate are not excelled by any in the world for the production of choice winter wheat, and all that is needed to utilize them is a new departure in our system of farming, and for the most intelligent farmers to put their heads together and their brains at work to find out by investigation and experiment the best means of cultivation for the various soils. If such manures and cultivation are given as are needed to produce a perfect growth, the wheat will keep ahead of all weather and all insects, and always give a good yield, and generally a large one. The best authorities now say that one bushel per acre is ample for seed if the ground is well prepared so that all the seed will grow. If this proves to be correct, that one bushel is better than one and one-half bushels per acre, it will make an aggregate saving of 1,000,000 bushels, or about that many dollars per annum.

CAUSES OF LOSS.

I think that on an average 10 per cent. of all the wheat grown is destroyed by exposure to rain in the shock for an unnecessary length of time and bad stacking. If wheat is badly stacked it is damaged much worse by a heavy rain than it could be if left standing in the shock. Then a large part of the wheat is depreciated in value, 5c. to 10c. per bushel, by the growth of cockle and rye with the wheat. The annual loss from these two causes cannot be less in the aggregate than $500,000 per annum. Most of it could be saved by a little additional care and the employment of a little additional labor. Indiana produces 30,000,000 bushels of wheat per annum, while she produces more than three times that much corn, and hay, fruits, potatoes, and vegetables in almost unlimited quantities—so much of the latter articles that her wheat product is almost unnoticed. Minnesota produces 30,000,000 to 40,000,000 bushels of spring wheat, and not much of anything else, but here the wheat production is heralded to the ends of the earth as a marvelous and wonderful thing. I find no fault with this, but simply state it as a remarkable fact. There are now over 12,000,000 acres of land in the farms of Indiana that are not cleared of the timber nor under cultivation. Here is employment for more than all the unemployed. Half or more of that which is under cultivation needs draining and other improvement. Labor is now cheap, and those of you who can should see none who desire to work remain idle. The towns and cities are sick. We have overtraded. We have built too many fine houses for which there is now no use. We have traded too much in corner lots, the value of which has faded out. Many of those who did the labor of building are out of work, and need and honestly want employment. We can not give it to them except to a limited extent. You can invite them to come and improve your farms, repair your houses and fences, and make new ones where they are needed. Let them become producers instead of consumers. This would end the hard times, kill communism, and stop the howl for more paper money. But I have again wandered far from the main question. I regret that I have not had more leisure to prepare something more deserving of your consideration. I will close by thanking you for your kind attention.—*Indiana Farmer.*

SEEDS AND SEED PLANTING.

By CHAS. H. SHINN, Niles, Cal.

TREE and shrub seed are most conveniently sown in boxes two or three feet square and four inches deep. The soil needs only to be rapidly mixed and pulverized with a shovel, thrown into the boxes, pressed, so that no settling will occur, and sown broadcast, the seed being covered with finer soil. The seeds of all conifers, such as juniper, cypress, and fir, sprout slowly, and require moisture, light covering, and a cool atmosphere to make them grow. Our best plan is to use a covering of laths, and sow the seed early, about the first of December, covering them with fine sand. When the young plants are just coming through the ground, affairs begin to approach a critical and troublesome period. Many people manage to learn the secret of sowing seed, but comparatively few understand the care of young seedlings during the dangerous portion of their existence, from the time they sprout to the appearance of the second leaves. If sowed too thick they come up in bunches, and lift the soil, thus exposing the roots. Hardy plants survive this evil, with a little thinning out, but tender plants require a little sprinkling of sand to fill the crevices. Sand is also good, if the soil gets too wet and covered with green moss, to dry the surface. If the plants get too much heat they wither; if too much damp they decay, and suddenly perish; if too much shaded or crowded they spindle, or become, as gardeners express it, "drawn," that is, they increase in height without a corresponding strength, the cellular tissue being merely lengthened, without additional width. Light, warmth, and moisture are the watchwords for most plants at this period. Avoid all extremes; do not let the surface get so dry that it crumbles to dust, or so wet that green scum forms on the top. Conifers need shelter from the direct sun, but tropical seedlings may be placed in the warmest place obtainable.

Seedlings of all kinds ought to stay in the seed boxes until the second leaves appear, and it is usually best to leave them until the third or fourth pair of leaves are seen and the stem has become somewhat hard. Plants that flower the first season ought then to be spaced in other boxes, giving them rather more room than they had before. Tree and shrub seedlings may with safety be left in the seed boxes for the first year, and then planted in rows in the open ground. The various palms and dracænas must be potted off early, or the roots grow so that they cannot be handled. Blue gums, eucalyptus globulus, sown in August, and spaced once, are fit for planting in spring. The garden flowers, such as carnations, asters, balsam, petunias, etc., will become stocky, and gifted with fibrous roots, after one or two transplantings. They can then be put in the garden, in masses, little groups, or as single specimens, as preferred. For handling small plants, use a knife blade or a trowel not larger than a teaspoon; for moving larger plants, and for garden work generally, a seven inch steel blade garden trowel will be needed.

Seeds, although carefully planted and watched, are subject to various living enemies, first among which may be mentioned mice; they are excessively fond of some kinds of seed, notably the blue gum, and will find exposed boxes, scratch up the surface, and take out every seed, leaving little hulls, in bitter mockery. Pine seed is another mouse delicacy. A greenhouse should be made safe against mice, and if one sneaks in occasionally he can be circumvented. Where seed boxes are, however, set on a porch, or in a shady place outdoors, the mice often commit depredations. The boxes can be covered with glass, or surrounded by strips of tin, and poison can be used with good effect.

The small red and black ants are also among the enemies of horticulture in general, and of seed sprouting in particular. We fervently advise every novice in the ancient art of gardening to study the ways of these restless and impudent rascals. If the flavor of any kind of seed suits their fastidious palates they will form in sedate military lines and carry off every seed in the box before you really discover the trick. I believe that ants are responsible for at least a few of the failures usually attributed to poor seed. If the seed they fancy are too large for one to shoulder, a number will unite, or else they will dig into it and carry off the kernel piecemeal. I have watched several minute red ants thus dissecting a canna seed and displaying as much zeal as if they were scientific men trying to discover the secret of life. Now and then they stop to consult, or to announce progress, thrusting their antennæ close together, then with renewed energy pushing the work of excavation till all the kernel was removed. Against ants, therefore, we must declare war of the relentless order. To save the boxes attacked make a heavy mark with chalk or tar on the edge of the box, trace the marauders to their nests, and drown them out with boiling water. Move your boxes and pots occasionally, and if they have started fresh colonies make matters unpleasant for them. It is not cruel, because it is better for them to move outdoors, and study nature. Besides - and here is the gist of the matter—we want the flowers.

The greatest danger which threatens seeds planted outdoors, and also small plants, especially conifers, arises from the presence of so many small birds through the winter in our mild climate. Salpiglossis, nemophila, ten-week stock, lobelia, and many other flowers, will be eaten off as soon as they appear. Vegetables often suffer. Pines and cypress, while small and tender, will be completely destroyed. If it were otherwise, field culture would be the cheapest way of growing our hardy evergreens, but the little birds snap them off as soon as they appear, and skip on the bushes saucily when the excited owner comes along, to astonish him with a flood of twitters, and a multitude of vibrant, melodious calls that half atone for the injury. The only effectual method of saving the plants is to cover them with lath frames until they are a couple of inches in height.

The growth of plants from seed, to sum up all in a sentence, requires the most patient, endless vigilance. It is the straightforward, natural way of propagation, but it is beset with minor difficulties. No one can start seed, except by accident, who does not think of their welfare, and examine them several times a day, until they are up, and large enough to transplant. By-and by you will learn how long it takes this and that kind of seed to germinate, you will know just how they look as they shake the soil from their brown garments, and unfold their new apparel of green; you will discover that from their very first appearance no two plants are precisely alike, and you will study their habits and progress. So seed planting will become the delight of delights, and seed-growth the mystery of mysteries.—*Gardener's Monthly.*

A RECENT VISIT TO THE CAVES OF ADELSBERG.

WE reached Adelsberg about 9 A.M., and after breakfasting at the hotel there, we drove to the caves in company with a Belgian *avocat* and his wife, with whom we had agreed to share the expenses, which were considerable, as we had resolved to "do the thing in style," and to see the caves at their best, and with that view had ordered an illumination of 1,800 candles, which is on the largest scale they provide.

The caves are a short mile from the town, and the entrance is not particularly striking. In that respect they are surpassed by the entrance of the Peak cavern in Derbyshire. We believe we entered at 11:5 A.M., and after traversing about 200 yards of a lofty moderately lighted passage, we suddenly came upon what appeared to be a gigantic hall. We were standing in a gallery, and far down in the depths beneath us the River Poik bubbled up, and rushed in a foaming stream toward the open air. The effect of the lights above and below was magnificent and rendered the darkness beyond exceedingly impressive. We seemed to be looking into infinity. Descending a staircase cut in the rock, we then traversed miles of passages, surrounded on all sides by a marvelous wealth of stalactites and stalagmites which have assumed the most beautiful and fantastic shapes. The general tendency is decidedly ecclesiastical, and the exquisite columns, fretted canopies, carved pulpits, and statuary, which we seemed to see at each step, reminded us irresistibly of our most far-famed cathedrals. Truly, he who desires to emulate or imitate the architectural masterpieces of bygone years could not do better than study the manifold effects which nature has here produced. It is the old story, Nature *versus* Art, and, as usual, Nature wins, in Newmarket parlance "hands down." In addition to these there were many other quaint effects: elephants' heads, lions, paroquets, monkeys, etc.; but we particularly admired the wonderful appearance of drapery, which was frequently perceptible. In one place, especially, which was well illuminated, the effect was quite perfect, an almost transparent curtain of different hues hanging in folds, with the hem clearly distinguishable along the edge. Here and there red earth (I suppose) had given a pale red color to the stalactites, but, as a rule, they are of the most dazzling white.

We occasionally passed into large open spaces. One is termed the ballroom, and is fine and well-shaped for the purpose, with a place on high for the orchestra. Hither, on Whit-Monday, come thousands of excursionists. Several bands discourse sweet music, and dancing and revelry are the order of the night. The temperature (about 48 degrees Fahr., Murray says) would be acceptable after an experience of London balls, the opportunities for "sitting out" unrivaled, but the floor is execrable. The furthest point we reached is the "Calvarien burg," and here we stood to all appearances in the midst of a vast *Campo santo*. In front, as far as the eye could reach, a medley of monuments of all shapes and sizes seemed to be piled up in profusion. On one side innumerable lights twinkling in the distance appeared to denote a town of some importance lying at our feet. The effect was very impressive, and we remained on the spot for some time trying to realize the true nature of the place.

On our return we saw several of the same effects from different points of view, and we eventually emerged into daylight at 1 P. M., having walked, we were informed, about five English miles in the bowels of the earth.

A guide afterward brought for our inspection a specimen of the *Proteus anguinus*, which is apparently a cross between an eel and a lizard, and has a long, light flesh-colored eel-like body, with two red fins at the head, and four legs with three toes on each foot. We could not discover its eyes, which are exceedingly minute. It is said to have been found only in this part of the neighborhood and in some parts of Sicily.—*K. N. in Land and Water.*

ABSORPTION OF CARBONIC OXIDE BY LIVING ORGANISMS.

N. GRÉHAUT has experimented with mixtures of air and minute portions of carbonic oxide. He finds that a man or an animal, when compelled for a half-hour to breathe an atmosphere containing only $\frac{1}{7\,1\,5}$ of carbonic oxide, absorbs that gas in sufficient quantities to saturate about half of the red globules of the blood, so that they become incapable of absorbing oxygen. In an atmosphere containing $\frac{1}{1\,4\,3}$ of carbonic oxide, about a quarter of the red globules are similarly saturated. These results are interesting and important in relation to physiology and hygiene.—*Comptes Rendus.*

A NEW REAGENT FOR CARBOLIC ACID.

THREE or four drops of a solution of one part of molybdenic acid in ten parts of concentrated sulphuric acid are added to the liquid to be tested, in a porcelain capsule. Is carbolic acid present, a light yellow or brown color is caused immediately, turning chestnut brown and finally purple. The solution to be tested must be very diluted, as otherwise other reactions take place.

HARBOR ILLUMINATION BY GAS.

THE harbor of Cronstadt and the river Neva will soon be illuminated by gas similarly as our streets and squares are lighted now. Buoys will be placed at certain intervals, at some distance below the surface of the water, filled with gas made according to the Pintz process. From the buoys tubes will extend above the surface, like street lamp posts, bearing a lamp. The buoys will need refilling once in two weeks.